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Harpacticoid Copepods of the Genus *Porcellidium* Associated with Marine Macroalgae in the Seas of Korea

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ABSTRACT

Six phytal harpacticoid species of the genus *Porcellidium* are recorded from 22 algal species in the eastern (Sea of Japan) and southern (Korea Strait) coast of Korea. Among these six species, *Porcellidium ofunatense* Harris and Iwasaki and *Porcellidium gamoi* (Harris and Iwasaki) are recorded as new to Korean fauna. Other four species are described as new to science: *Porcellidium bipartitum* n. sp. found from a single algal species, *Porcellidium wandoensis* n. sp. from ten algal species, *Porcellidium acutum* n. sp from five algal species, and *Porcellidium brevicacum* n. sp. from two algal species. It is found that the associations between the species of *Porcellidium* and macroalgae reveal weak specificities.

Key words: *Porcellidium*, Harpacticoida, marine algae, Korea.

INTRODUCTION

The harpacticoids of *Porcellidium*, characteristically having the dorsoventrally flat body and highly chitinized tergites, have been found mainly on marine macroalgae (Hicks and Webber, 1983). Since Lang (1948) who recorded nine species as valid, many more species have been recorded newly. Recently Kim and Kim (1996) described two new species, and Harris and Iwasaki (1996a, b) described three and four new species, respectively. At present the genus contains 51 named species. In Korea there is no valid taxonomical report found except for the two species recorded by Kim and Kim (1996) as the associates of the hermit crabs.

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Porcellidium had been known as the monotypic genus of Porcellidiidae until Harris and Robertson (1994) founded the second genus, *Acutiramus*. Soon after, Harris (1994) and Harris and Iwasaki (1996b) added several new genera. However, as indicated by Huys *et al.* (1996), these genera were proposed on the basis of ambiguous definitions and are hardly justifiable.

Recently the authors have been observed the small epiphytic animals. Among these the harpacticoid copepods have been most frequently observed. It is recorded that some of phytal harpacticoids may gnaw or bore the marine macroalgae (Ho and Hong, 1988). But there is few records dealing with any ecological relationships between the copepods and marine macroalgae till now. Among the harpacticoids taken from the macroalgae, the material of the genus *Porcellidium* were most attractive due to their characteristic body form. Unfortunately it was found that this group of harpacticoids has been ignored taxonomically in this country, as well as in the whole oriental region. This fact led the authors to describe in this paper the species of *Porcellidium* collected in the Korean coasts.

The material examined in this paper were washed out from the macroalgae in the shallow sublittoral waters of less than 10 m depth. The collectings were done in the summer of 1996 and May, 1997. To collect the epiphytic animals including the harpacticoids, the bags (20 x 20 x 40 cm, pore size 150 ㎛) made of a acrylic texture were used. With the aid of SCUBA apparatus in the water, the macroalga of a given species was wrapped with the bag and removed from the bottom. After soaking the bags containing the algae for about an hour in 10 % sea water-formalin solution, the algae were taken out of the bags and washed in the sea water in containers. Then, the animals submerged on the bottom of the containers were sorted out and preserved in 70 % alcohol.

Prior to dissecting and observing, the material were soaked in lactic acid for at least one hour. The type specimens of new species will be deposited in the U. S. National Museum of Natural History, Smithsonian Institution, United States. In the descriptions of species, the full descriptions are made for the new species, but for new records of Korean fauna only the full illustrations are given.

Family Porcellidiidae Brady, 1880

Genus *Porcellidium* Claus, 1860

Porcellidium bipartitum n. sp. (Figs. 1-3)

Type specimens. Holotype (♀), allotype (♂), and paratypes (20♀♀ and 50 ♂♂) collected from *Ecklonia cava* Kjellman, shallow sublittoral, at Maemul-do Island in Korea Strait, on 22 July 1996.

Female. Body (Fig. 1A) relatively large, dorsoventrally flat, 1.71 mm long, and 1.13 mm in maximum width. Prosome 4-segmented, but both anterior and posterior boundaries of fourth pedigerous somite obscure in dorsal view. First pedigerous somite completely fused with cephalosome, both forming cephalothorax. Cephalothorax and following two prosomal somites rimmed with membrane on lateral margins. Second and third pedigerous somites with well developed epimeral plates, those of third pedigerous somite rudimentary. Urosome 3-segmented. Abdomen (Fig. 1B) 2-segmented. Anal somite dorsally covered in most part by genital double somite. Genital double somite nearly ovoid, distinctly wider than long, without angular corners, 550 ㎛ long, and 720 ㎛ wide. Its lateral margins smooth, without spinules or hairs. Posterior cleft of genital double somite long, 290 x 215 ㎛, 1.35 times as long as wide, and slightly longer than half length of somite.

Anterior and posterior lobes of genital double somite fused, with long line as a vestige of fusion, but without notch or incision. Posterior corners of genital double somite blunt, not angular, and terminated in same level of caudal rami.

Caudal ramus (Fig. 1C) 250 x 87 µm, 2.87 times as long as wide, both margins nearly straight. Outer margin slightly longer than inner one and gradually widened distally, with minute spinules in distal portion. Terminal margin weakly convex, with dense minute spinules. α-seta (proximal one of dorsal setae) located at 55 % length of caudal ramus from terminal margin, and 47 % width of caudal ramus from outer margin, its length about half of caudal ramus. β-seta located at 40 % from terminal margin and at 37 % from outer margin. γ-seta located near terminal margin, nearby seta 1. Setae 2 and 3 very small, hardly distinguishable from hairs of terminal margin. Setae 4 small, its distance from inner margin nearly identical to that from γ-seta to outer margin.

Rostrum shaped as a reversed triangle, and protruded beyond anterior margin of cephalothorax. Antennule (Fig. 1D) 273 µm long and 6-segmented, with setal formula approximately 1, 13, 8, 6+1 aesthetasc, 5, and 12+1 aesthetasc. Larger ones among setae annulated. Antenna (Fig. 1E) with short coxa. Basis with 1 seta distally and many denticles on medial side. Exopod 1-segmented, with 3 lateral setae and terminally 3 setae and 1 foliaceous process. All setae serrated. Endopod 2-segmented. First segment slightly longer than wide, with denticles on medial side. Second segment with 4 smaller lateral setae and distally 3 setae (2 of which distinctly smaller) and 4 spines. Distalmost spine of the latter short and thick, with denticles laterally. Other 3 spines geniculate and smooth.

Mandible (Fig. 1F) with exopod having 6 thick, plumose setae and 3 slender, smooth setae. Endopod with 4 thick, plumose setae on anterior lobe and on posterior lobe 5 thick, plumose setae and 1 slender, smooth seta. Maxillule (Fig. 2A) with 9 setae on arthrite, 2 of which located laterally. Coxa with 5 setae. Basis with 2 endites, and 5 and 4 setae on each endite. Exopod with 2 plumose setae. Endopod with 6 setae, of which 2 inner and 2 outer setae plumose only on one side. Maxilla (Fig. 2B) with 2 endites on syncoxa, and 2 and 3 setae on each endite. Basis with 2 endites, and 1 small and 1 large setae on proximal endite and 1 small and 1 thick setae on distal endite. Endopod indistinctly 2-segmented, with 3 + 2 large, strong setae. Syncoxa of maxilliped (Fig. 2C) distinctly wider than long, with 1 seta. Basis unarmed, with oblique distal border. Endopod 2-segmented. First segment with 1 plain seta and 1 thick, geniculate seta. Second segment with 2 thick, geniculate setae.

Leg 1 (Fig. 2D) with 3-segmented exopod and 2-segmented endopod. Outer seta of basis distinctly expanded. Distal seta of terminal segment of exopod smooth; other exopodal setae plumose. First segment of endopod large and triangular, distally with transverse row of long hairs and with a patch of minute spinules in the middle of outer side. Second segment with 2 spines, these spines with membrane-like ornament.

Leg 2 (Fig. 2E) and leg 3 (Fig. 2F) with 3-segmented rami, but leg 4 (Fig. G) typically with 3-segmented exopod and 2-segmented endopod. Armature formula of legs 2-4 as follows.

P2: exp. I-1; I-1; III,2,2 enp. 0-1; 0-2; 2,2
P3: exp. I-1; I-1; III,2,3 enp. 0-1; 0-2; 2,3
P4: exp. I-1; I-1; III,2,3 enp. 0-1; 2,3

Outer spines on exopods of legs 3 and 4 long, slender, and setiform. Proximal seta on endopodal second segment of leg 3 enlarged, curved distally, and crenulated on medial margin. Second medial seta of endopodal third segment of same leg likewise specialized. Other setae on second and terminal segments slender, serrated or weakly plumose.

Setae of endopodal second segment of leg 4 serrated; distalmost seta of terminal segment distinctly elongated. Exopodal segments of legs 2-4 with spinules on outer margin.

Leg 5 (Fig. 2H) short, not embracing genital double somite, its distal end not approaching to boundary between anterior and posterior lobes of somite. Baseoendopod distally with 1 plumose seta. Exopod about 350 μm long, with 5 setae; largest one of them located on the middle of outer margin; other 4 identically small setae located near distal end. Outer margin near middle seta with minute spinules. Inner margin almost straight.

Male. Body (Fig. 3A) 1.05 mm long and 0.81 mm in maximum width, with 4-segmented prosome and 3-segmented urosome. Anterior margin of cephalothorax straight except for rostral area which is slightly convex. Rostrum not demarcated from cephalothorax. Epimeral plates of all prosomal somites rimmed laterally with membrane. Urosome (Fig. 3B) 1/4 times as long as whole body. Genital somite 130 x 237 μm, with convex anterior border and distinctly concave posterior border. Posterior corners prominent with several spinules. Caudal ramus 77 x 83 μm, slightly wider than long, with straight and leveled terminal margin. All dorsal setae smooth. Seta 1 short and plumose, but other setae on terminal margin smooth and very small.

Antennule (Fig. 3C) 4-segmented, geniculate between third and terminal segments. Approximate setal formula: 1, 11, 17+1 aesthetasc, and 12+1 asthetasc. First segment greatly expanded laterally, with thick hairs on anterior margin. Third segment (Fig. 3D) with large process, accessory lobe, the latter tipped apically with 2 unequal setae, and 3 transformed spines. These spines cup-shaped and crenulated along distal margin. Terminal segment (Fig. 3E) with strong process proximally and 2 more smaller processes distal to proximal one; distal portion of segment curved and beak-like.

Terminal endopodal segment of leg 2 with 2 or 3 setae. Legs 1, 3 and 4 identical to those of female. Exopod of leg 5 130 x 73 μm, outermost one of 6 terminal setae smooth and longest; other 5 setae plumose and almost identical in size.

Etymology. The specific name *bipartitum* is derived from the Latin *bipartitus* (= divided in two), alluding the two-segmented endopod of leg 4.

Remarks. In the genus *Porcellidium*, there are some species, as *P. bipartitum* n. sp., carrying a large sclerotized process ("anterior blade" called by Harris and Robertson, 1994) on the third segment of male antennule and the well developed setae 2 and 3 on the female caudal rami. Harris and Robertson (1994) named this group of species as the *hormosirii* group and assigned seven species to this group: *Porcellidium algoense* Hicks, 1982, *P. erythrogastrum* Harris and Robertson, 1994, *P. hartmannorum* Tiemann, 1978, *P. hormosirii* Harris and Robertson, 1994, *P. ocellum* Harris and Robertson, 1994, *P. pulchrum* Harris and Robertson, 1994, and *P. rubrum* Pallares, 1966.

The largest female body recorded so far among these species is 0.83 mm long for *P. erythrogastrum* Harris and Robertson. Although the body size is variable depending on individuals and thus is not important in the taxonomy of *Porcellidium*, the new species has the exceptionally large body length, 1.71 mm, more than twice length of other species in this group. More important

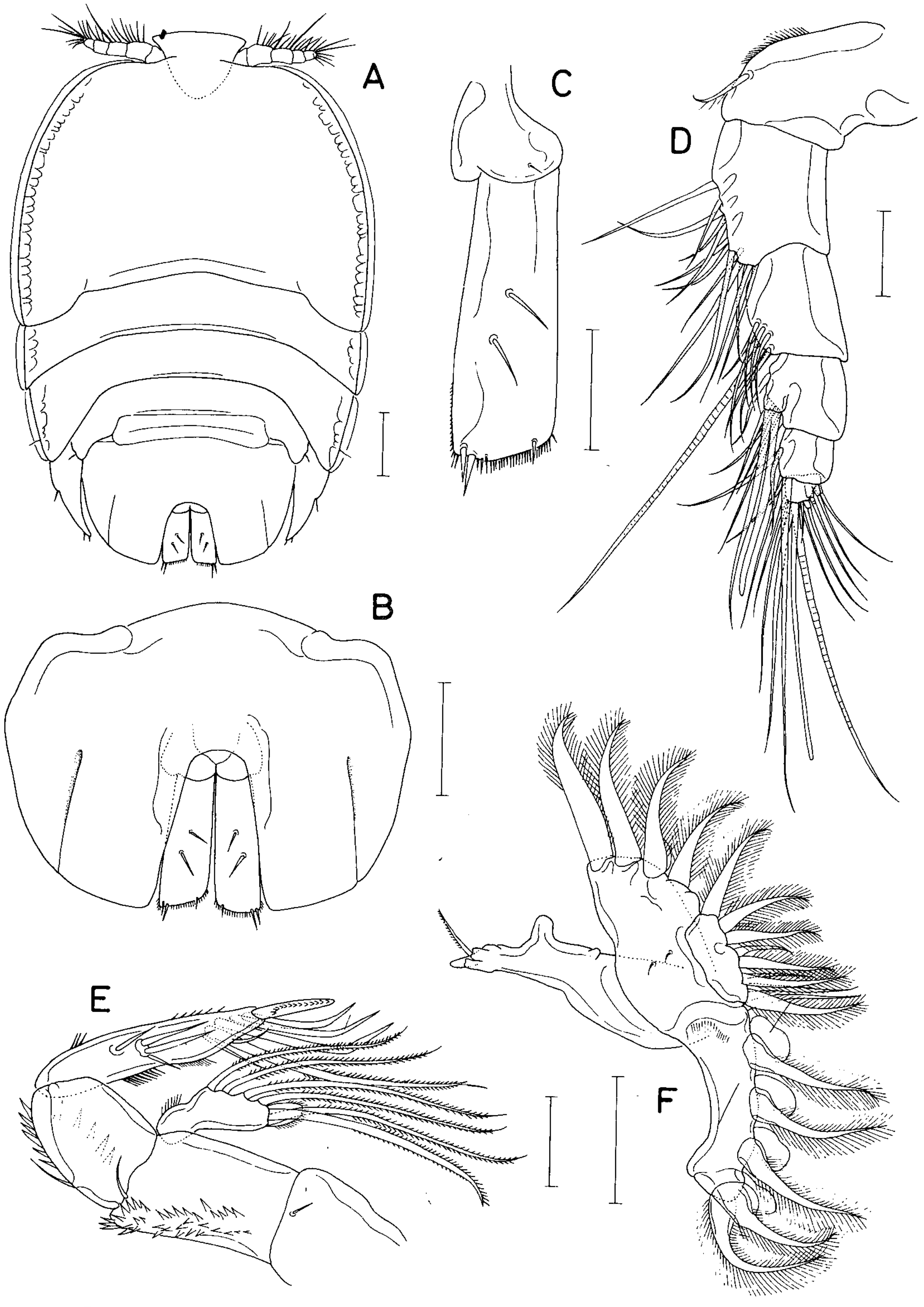

Fig. 1. *Porcellidium bipartitum* n. sp., female. A, habitus, dorsal; B, abdomen, dorsal; C, caudal ramus, left, dosal; D, antennule; E, antenna; F, mandible. Scales: A, B = 0.2 mm; D, F = 0.1 mm; D, E = 0.05 mm.

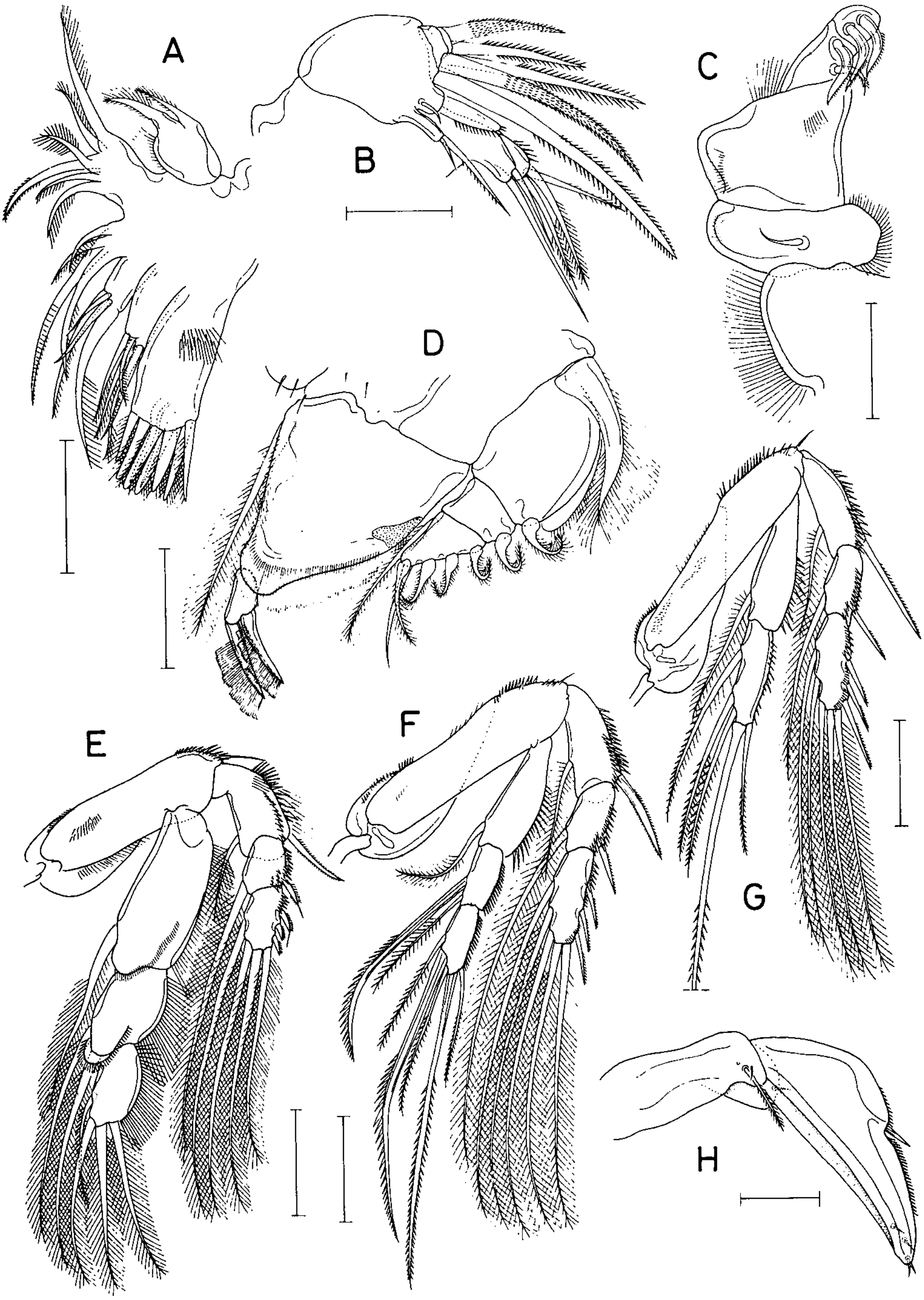

Fig. 2. *Porcellidium bipartitum* n. sp., female. A, maxillule; B, maxilla; C, maxilliped; D, leg 1; E, leg 2; F, leg 3; G, leg 4; H, leg 5. Scales: A-C = 0.05 mm; D-H = 0.1 mm.

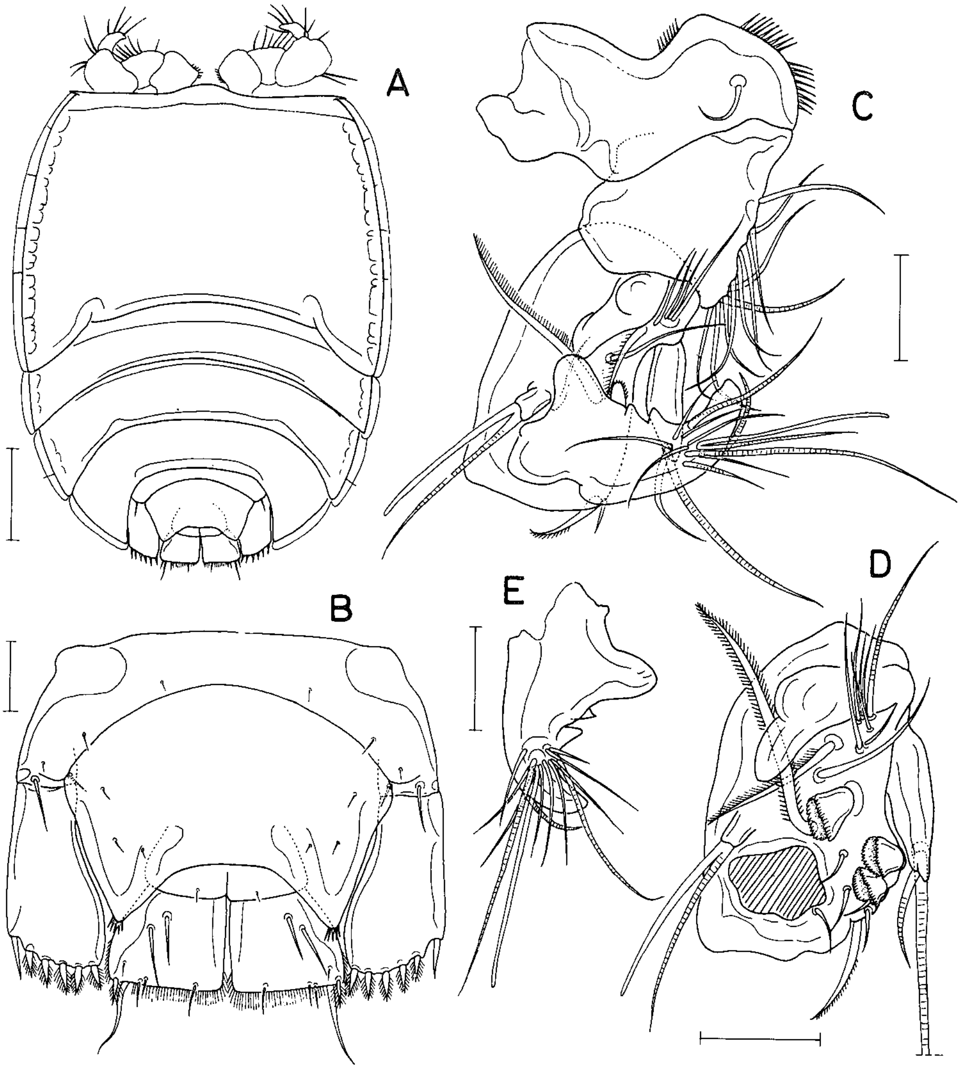

Fig. 3. *Porcellidium bipartitum* n. sp., male. A, habitus, dorsal; B, urosome, dorsal; C, antennule; D, third segment of antennule; E, terminal segment of antennule. Scales: A = 0.2 mm; B-E = 0.05 mm.

differentiating feature of *P. bipartitum* is that the endopod of fourth leg is two-segmented. This is an unique feature of the new species that has not been recorded in *hormosiri* group, as well as in all known species of *Porcellidium*, as far as we are aware.

While Harris (1994) and Harris and Iwasaki (1996b) proposed *Kioloaria*, *Murramia* and *Clavigofera*, as new genera, they considered the presence of three setae on the endopodal third segment of male leg 2 as an important characteristic defining these three genera. However, the armature state on this part of the leg seems not valuable in the taxonomy of *Porcellidium*, because it may be variable depending on individuals in a same species, as seen in *P. bipartitum*.

***Porcellidium wandoensis* n. sp. (Figs. 4-6)**

Type specimens. Holotype (♀), allotype (♂), and paratypes (50♀♀ 30♂♂), collected from *Gymnogongrus flabelliformis* Harvey, at Wando Island, on 30 July 1996.

Other amterial exmined. 29♀♀ 22♂♂ collected from *Enteromorpha linza* (L.) J. Agardh, at Wando Island, on 30 July 1996; 3♀♀ from *Sargassum thunbergii* (Roth) Kuntze, at Wando Island, 30 July 1996; 8♀♀ 1♂ from *Ishige okamurae* Yendo, at Wando Island, on 30 July 1996; 2♀♀ 1♂ from *Symphyocladia latiuscula* (Harvey) Yamada, at Wando Island, on 30 July 1996; 7♀♀ from *S. linearis* (Okamura) Falkenberg, at Dolsan-do Island, on 31 July 1996; 7♀♀ 6♂♂ from *Laurencia okamurae* Yamada, at Dolsan-do Island, on 31 July 1996; 19♀♀ 15♂♂ from *Hizikia* fusiformis (Harvey) Okamura, at Dolsan-do Island, on 31 July 1996; 6♀♀ 4♂♂ from Chodium *fragile* (Suringer) Hariot, at Dolsan-do Island, on 31 July 1996; 12♀♀ 2♂♂ from *Enteromorpha linza* (L.) J. Agardh, at Dolsan-do Island, on 31 July 1996; 2♀♀ 2♂♂ from *Chondrus ocellatus* Holmes, at Dolsan-do Island, on 31 July 1996; 5♀♀ 3♂♂ from *Hizikia fusiformis* (Harvey) Okamura, at Kijang, on 1 August 1996; 2♀♀ 1♂, *Chondrus ocellatus* Holmes, at Kuryongpo, on 2 August 1996.

Female. Body (Fig. 4A) charactistically light blue in color, 763 μm long, with maximum width 475 μm. Cephalothorax and 2 succeeding prosomal somites with membraneous rim on lateral margins of epimeral plates. First pedigerous somite fused completely to cephalosome, both forming cephalothorax. Urosome 3-segmented. Fifth pedigerous somite vaguely demarcated from genital double somite. Abdomen (Fig. 4B) 2-segmented. Genital double somite 215 x 285 μm, nearly triangular; posterior cleft 113 μm long, with maximum width 127 μm, slightly wider than long, and slightly longer than half length of somite; anterior and posterior lobes fused, leaving only faint line as a vestige of fusion, without notch or incision; posterior three quarters of lateral margin with minute spinules (or stiff hairs).

Caudal ramus (Fig. 4C) 112 x 55 μm, 2.04 times as long as wide, gradually widened distally, with nearly straight lateral margins. Inner margin slightly longer than outer one. Terminal margin slightly convex, with dense, stiff hairs. Distal portion of outer margin with minute spinules. Distal half of inner margin with short hairs. α-seta located at 75 % length of ramus from terminal margin and 25 % width of ramus from outer margin, half as long as ramus.

β-seta located at 45 % length of ramus from terminal margin and 16 % width of ramus from outer margin. γ-seta longest among caudal setae and located near terminal margin. Setae 1-4 of terminal margin all small and plumose. Setae 2 and 3 of these located close to each other in the middle of terminal margin. Caudal rami extended slightly over distal end of genital double somite.

Rostrum almost concealed by cephalothorax in dorsal view. Antennule (Fig. 4D) 138 μm long and 6-segmented, with approximate setal formula. 1, 11, 8, 5+1 aesthetasc, 5, and 9+1 aesthetasc. Antenna (Fig. 4E) with short coxa. Basis with many denticles on medial side. Exopod 1-segmented, with 4 lateral and 2 distal setae. These setae serrated. Endopod 2-segmented. First segment slightly longer than wide, with denticles on medial side. Second segment with 4 small lateral setae and distally 2 setae and 4 spines. Distalmost one of latter setae short and thick, with spinules on margins. Other

3 spines serrated and geniculate.

Mandible (Fig. 4F) not different from that of previous species. Maxillule (Fig. 4G) with arthrite having 11 setae. Coxa armed with 5 setae. Basis with 2 endites, each bears 4 setae. Exopod with only 1 plumose seta. Endopod armed with 6 setae, of which outermost one with spinulated, innermost 2 setae plumose on inner side, and remaining 3 setae smooth. Maxilla (Fig. 5A) with syncoxa having 2 endites, each endite carrying 2 setae at tip. Other portion as in previous species. Maxilliped (Fig. 5B) with 1 smooth seta on syncoxa. Basis without seta, but with large anterodistal process. Anterior margin with long hairs. Endopod 2-segmented; first segment with 1 plain and 1 geniculate setae; second segment with 2 geniculate setae.

Leg 1 (Fig. 5C) with 3-segmented exopod and 2-segmented endopod. Outer seta of basis distinctly enlarged. Segments of exopod armed with 1, 1, 6 setae respectively, of which terminal one of terminal segment smooth and distinctly longer. First segment of endopod large and triangular, with 1 long proximal setae on medial margin, 1 transverse row of long hairs distally, and a patch of minute spinules near middle of outer magin. Second segment with 2 membrane-carrying spines..

Legs 2 to 4 (Fig. 5D-F) with trimerous rami. These legs with following formula of armature.

P2: exp. I-1; I-1; III,2,2 enp. 0-1; 0-2; 2,2
P3: exp. I-1; I-1; III,2,3 enp. 0-1; 0-2; 1,3,1
P4: exp. I-1; I-1; III,2,3 enp. 0-1; 0-1; 2,2

Outer spines of exopods of legs 3 and 4 setiform. Second seta of endopodal third segment of leg 3 enlarged, its distal half curved and serrated on inner margin. Outer margins of exopodal segments of legs 2-4 with spinules.

Leg 5 (Fig. 5G) with 2 distal setae, each on dorsal and ventral surface. Exopod 205 ㎛ long, its distal end not extending to end of genital double somite, with minute spinules on nearly all outer margin. Seta on outer margin located slightly distal to midway outer margin. Other 4 setae small, but unequall in size, 2 (1 being tiny) of them located terminally.

Male. Body (Fig. 6A) 616 ㎛ long, with maximum width of 437 ㎛, composed of 4-segmented prosome and 3-segmented urosome. Rostral area of cephalothorax convex. Rostrum fused to cephalothorax. All prosomal somites with membrane on lateral margins of epimeral plates. Urosome (Fig. 6B) 173 ㎛ long, shorter than 1/3 legnth of whole body. Genital somite 79 x 150 ㎛, nearly quadrangular, with concave posterior border. Posterior corners with several hairs. Caudal ramus 57 x 54 ㎛, nearly as long as wide, widened distally, with slightly covex outer margin and straight inner margin. All dorsal setae smooth, of which r-seta being the longest. Seta 1 largest among terminal setae; other 3 terminal setae nearly identical in size. Terminal margin and distal portion of both lateral margins with hairs.

Antennule (Fig. 6C) 5-segmented, but fifth segment very small (Fig. 6D), with geniculation between third and fourth segments. First to third segmens armed with 1, 13, 18+1 aesthetasc, respectively. Armature of distal segments obscure. First segment greatly expanded laterally, with thick hairs on anterior margin. Third segment without basal process, but with 2 accessory lobes tipped each 1 seta; one of setae near accessory lobes expanded basally; 3 transformed spines present on this segment, distal margin of these spines serrated.

Endopodal terminal segment of leg 2 with 2 setae. Legs 1, 3 and 4 showing no sexual dimorphism.

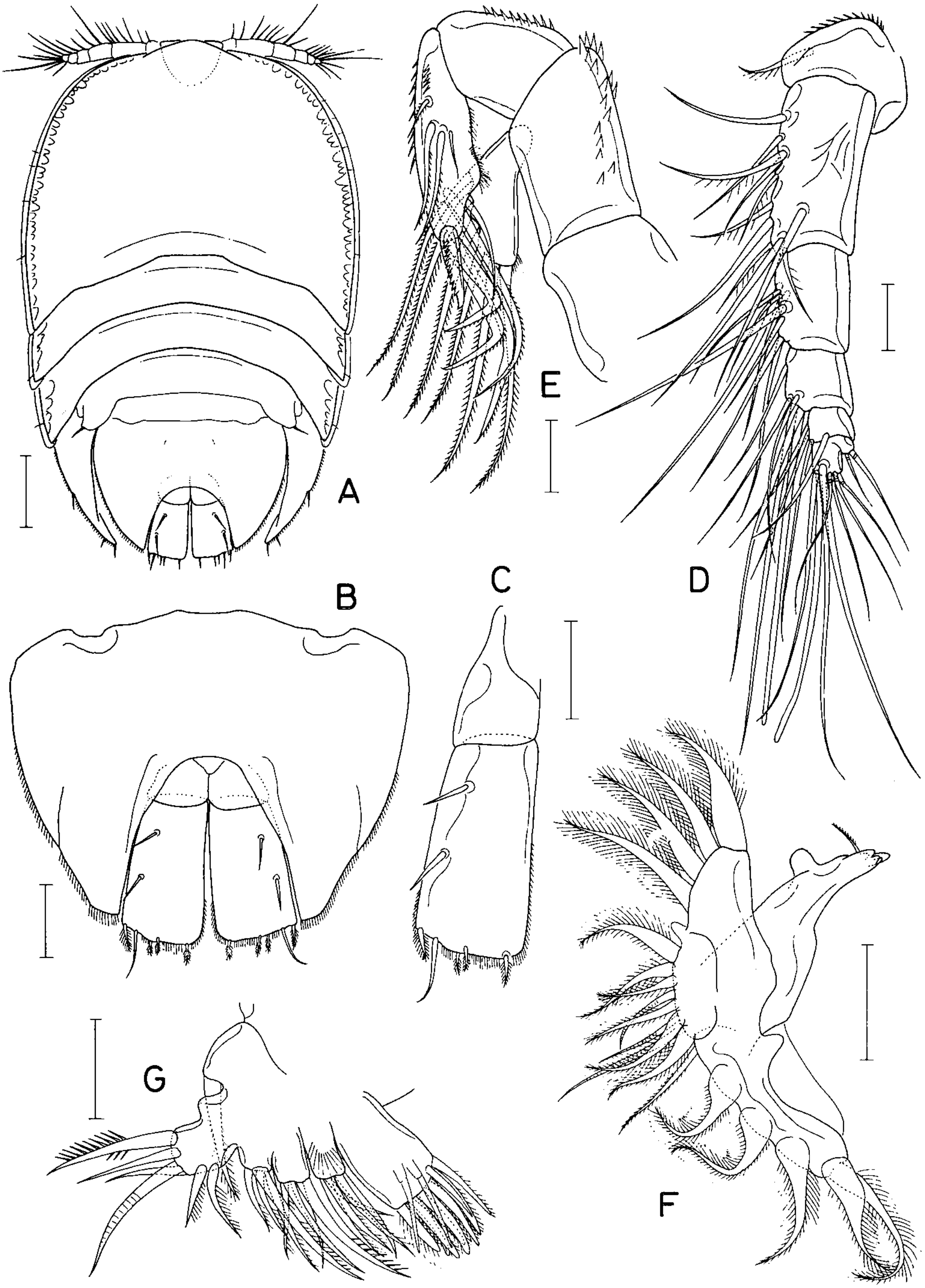

Fig. 4. *Porcellidium wandoensis* n. sp., female. A, habitus, dorsal; B, abdomen, dorsal; C, caudal ramus, left, dorsal; D, antennule; E, antenna; F, mandible; G, maxillule. Scales: A=0.1 mm; B, C, F=0.05 mm; D, E, G= 0.02 mm.

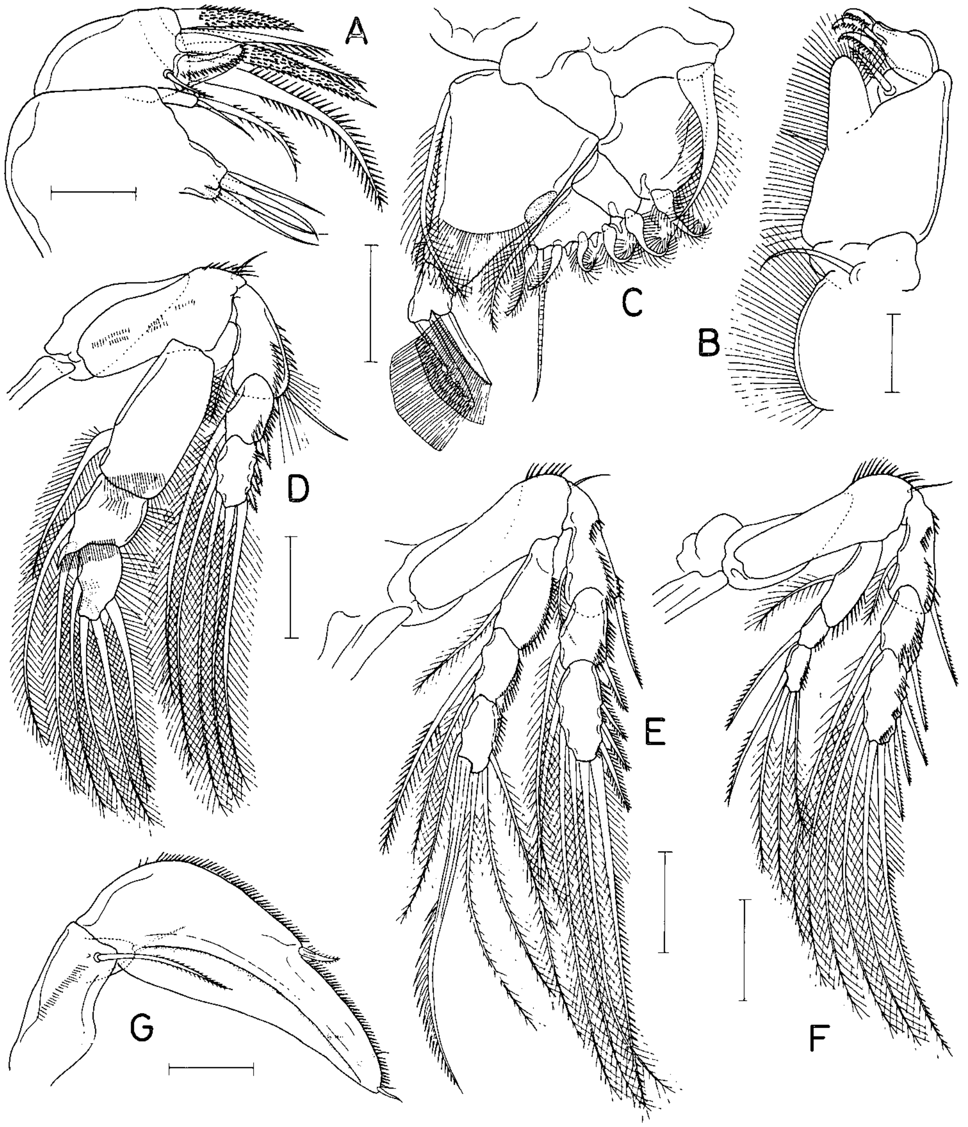

Fig. 5. *Porcellidium wandoensis* n. sp., female. A, maxilla; B, maxilliped; C, leg 1; D, leg 2; E, leg 3; F, leg 4; G, leg 5. Scales: A, B= 0.02 mm; C-G= 0.05 mm.

Exopod of leg 5 96 x 63 μm, with 6 setae on terminal margin of identical shape and size.

Etymology. The specific name *wandoensis* derived from the type locality, Wando Island located in the Korea Strait.

Remarks. Harris and Robertson (1994) grouped members of *Porcellidium* devoid of a sclerotized process on the third segment of male antennule as *naviculum* group. To this group Harris and Robertson (1994) and Harris Iwasaki (1996) assigned five species they described and three previously known species, *P. erythrum* Hicks, 1971, *P. sarsi* Bocquet, 1948, and *P. viride* (Phillipi, 1840).

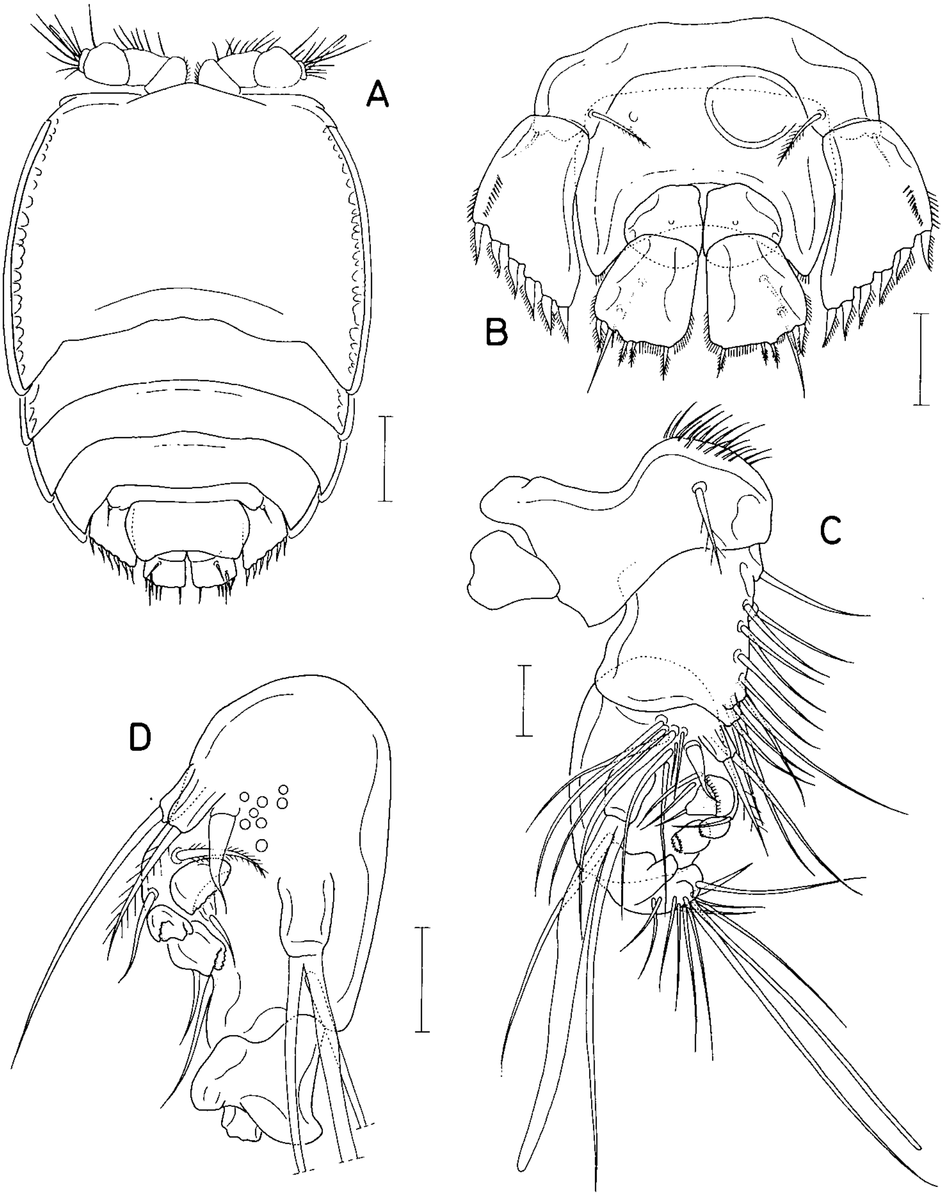

Fig. 6. *Porcellidium wandoensis* n. sp., male. A, habitus, dorsal; B, urosome, ventral; C, antennule; D, distal segments of antennule (open circles represents the places of insertion of setae). A= 0.1 mm; B= 0.05 mm; C, D= 0.02 mm.

Porcellidium wandoensis n. sp. belongs also to this group.

It is noted that the harpacticoids of *Porcellidium* show few taxonomic characters in the legs and other appendages. Among the morphologies, the shape of caudal rami are usually used in differentiating the species, as Ho (1986) did. The caudal ramus of the new species is 2.04 times as long as wide. Only two species of *naviculum* group, *P. sarsi* Bocquet and *P. ofunatense* Harris and

Iwasaki, 1996, are known to have this range of ratio in caudal ramus, as the new species. Although Bocquet (1948) did not mentioned about the size of caudal ramus, this part of body of *P. sarsi* can be measured as about 2.2:1 when his illustration is referred to. In the description of *P. ofunatense*, Harris and Iwasaki (1996) recorded the ratio of caudal ramus of this species as 2.4. But this ratio of Korean specimens to be redescribed in this paper is 2.09. *P. viride* is not known of this ratio. However according to Lang' s (1948) illustration, this species is different from the new species in the position of α- and β -setae of caudal ramus. In this European species the α-seta is isolated from the terminal margin by the distance of 90 % length of caudal ramus, and the β-seta is isolated by 60 %, in costrast to 75 % and 45 %, respectively, of the new species.

Most of all, it is noted that the color of the new species is blue. This color of the new species is constant, not related to the color of the associated algae. This seems an important feature, because the species mentioned above are known to carry yellow or brown color, except for *P. viride* in which the body color is unknown.

***Porcellidium ofunatense* Harris and Iwasaki, 1996 (Figs. 7-9)**

Porcellidium ofunatense Harris and Iwasaki, 1996a, p. 137, figs. 2-5.

Material examined. 31♀♀ 9♂♂ collected from *Pachymeniopsis elliptica* (Holmes) Yamada, at Wando Island, on 30 July 1996; 7♀♀ 1♂ from *Chondrus ocellatus* Holmes, at Dolsan-do Island, on 31 July 1996; 22♀♀ 10♂♂ from *Ulva pertusa* Kjellman, at Kijang, on 1 August 1996; 28♀♀ 13♂♂ from *Pachymeniopsis elliptica* (Holmes) Yamada, at Kijang, 1 August 1996; 6♀♀ 2♂♂ from *Chondrus ocellatus* Holmes, at Kijang, on 1 August 1996; 97♀♀ 63♂♂ from *Gymnogongrus flabelliformis* Harvey, at Kuryongpo, on 2 August 1996; 5♀♀ 2♂♂ from *Chodium fragile* (Suringer) Hariot, at Kuryongpo, on 2 August 1996; 17♀♀ 2♂♂ from *Caulerpa okamurae* Werber van Bosse, at Kuryongpo, on 2 August 1996; 33♀♀ 20♂♂ from *Chondrus ocellatus* Holmes, at Kangnung, on 28 May 1997; 41♀♀ 11♂♂ from *Pachymeniopsis elliptica* (Holmes) Yamada, at Kangnung, on 28 May 1997; 12♀♀ 10♂♂ from *Ulva pertusa* Kjellman, at Kangnung, on 28 May 1997; 27♀♀ 2♂♂ from *Laminaria japonica* Areschong, at Kangnung, on 28 May 1997.

Remarks. In consideration to the morphology of the female urosome including the caudal rami and the armature of antennular third segment of male, our specimens are identified with this species. Harris and Iwasaki (1996a) recorded 0.94 mm for the body length of female, 1.45 for the ratio of length to width of female genital double somite, and 2.4 for the ratio of length to width of caudal ramus. These measurements do not coincide with ours, but we consider these are minor differences.

***Porcellidium acutum* n. sp. (Figs. 10-12)**

Type specimens. Holotype (♀), allotype (♂), and paratypes (20♀♀ 3♂♂) collected from *Ulva pertusa* Kjellman, at Maemul-do Island (shallow sublittoral) in Korea Strait, on 22 July 1996.

Other material examined. 3♀♀ 2♂♂ from *Chodium fragile* (Suringer) Hariot, at Maemul-do Island, on 22 July 1996; 49♀♀ 3♂♂ from *Sargassum fulvellum* (Turner) C. Agardh, at Maemul-do Island, on 22 July 1996; 55♀♀ 3♂♂ from *Sargassum confusum* C. Agardh, at Maemul-do Island, on 22 July 1996; 5♀♀ from *Agarum cribrosum* Bory f. *yakishiriense* Yamada, at

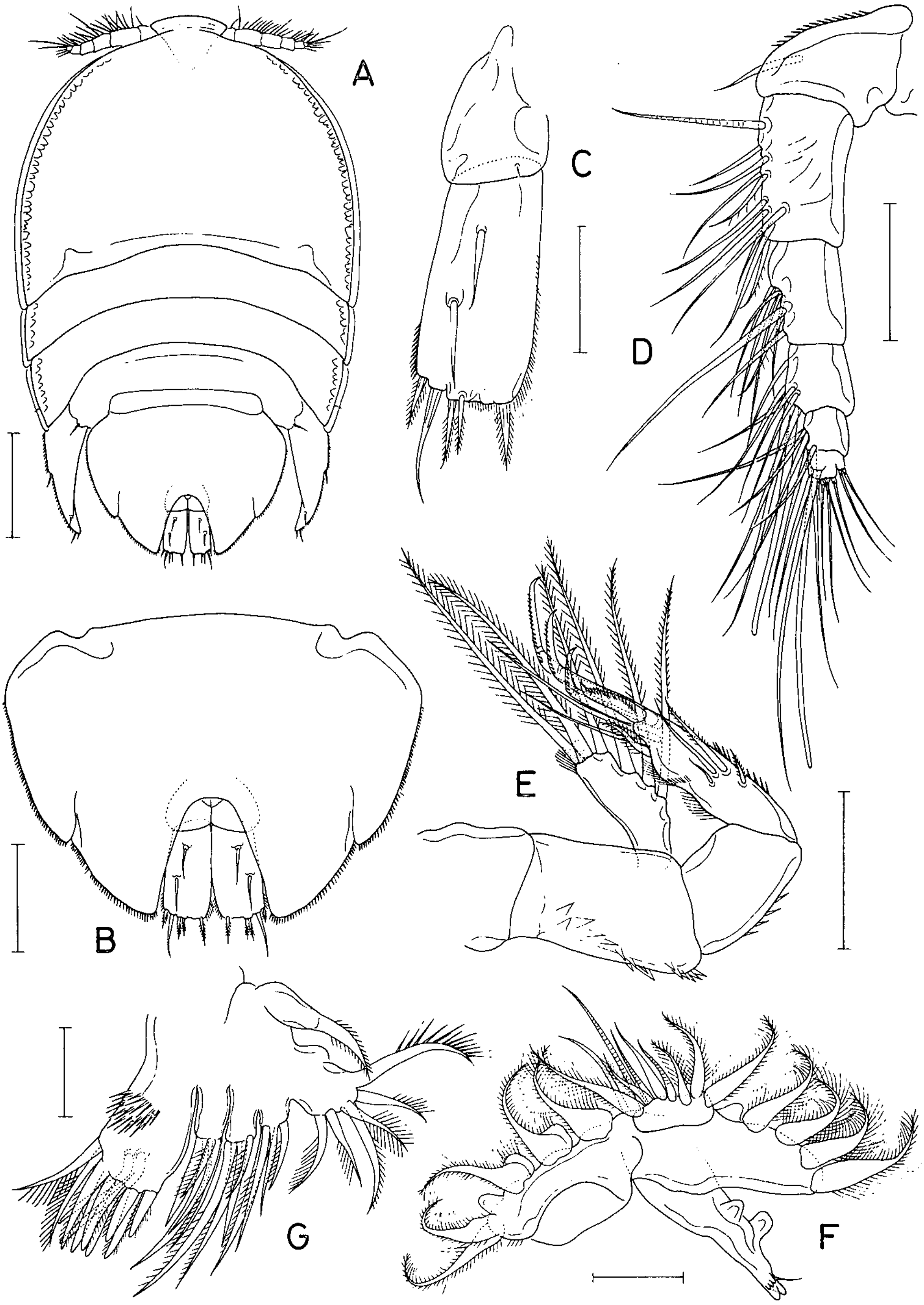

Fig. 7. *Porcellidium ofunatense* Harris and Iwasaki, female. A, habitus, dorsal; B, abdomen, dorsal; C, caudal ramus, left, dorsal; D, antennule; E, antenna; F, mandible; G, maxillule. Scales: A= 0.2 mm; B= 0.1 mm; C-F= 0.05 mm; G= 0.02 mm.

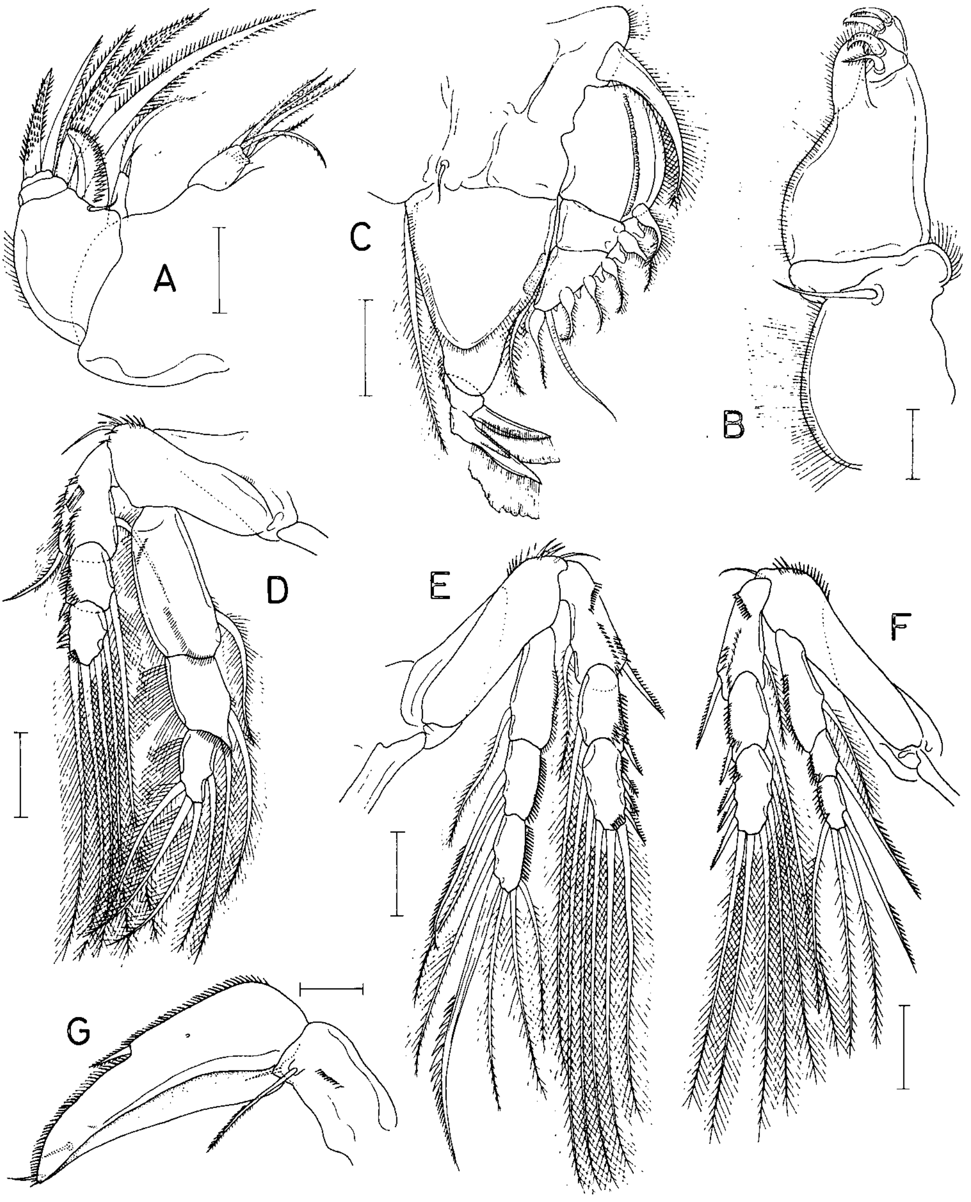

Fig. 8. *Porcellidium ofunatense* Harris and Iwasaki, female. A, maxilla; B, maxilliped; C, leg 1; D, leg 2; E, leg 3; F, leg 4; G, leg 5. Scales: A, B= 0.02 mm; C-G= 0.05 mm.

Kangnung, on 28 May 1997.

Female. Body (Fig. 10A) 908 ㎛ long, with maximum width 563 ㎛. Second and third pedigerous somites with well developed epimeral plates. Cephalothorax and these 2 prosomal somites with membraneous rim on lateral margins of epimeral plates. Urosome 3-segmented. Abdomen (Fig. 10B) 2-segmented, 230 ㎛ long, 292 ㎛ wide, and roughly triangular. Posterior cleft of genital double somite 125 x 153 ㎛, distinctly wider than long, and longer than half length of somite. Boundary between anterior and posterior lobes of genital double somite vestigial, leaving only short rudimentary

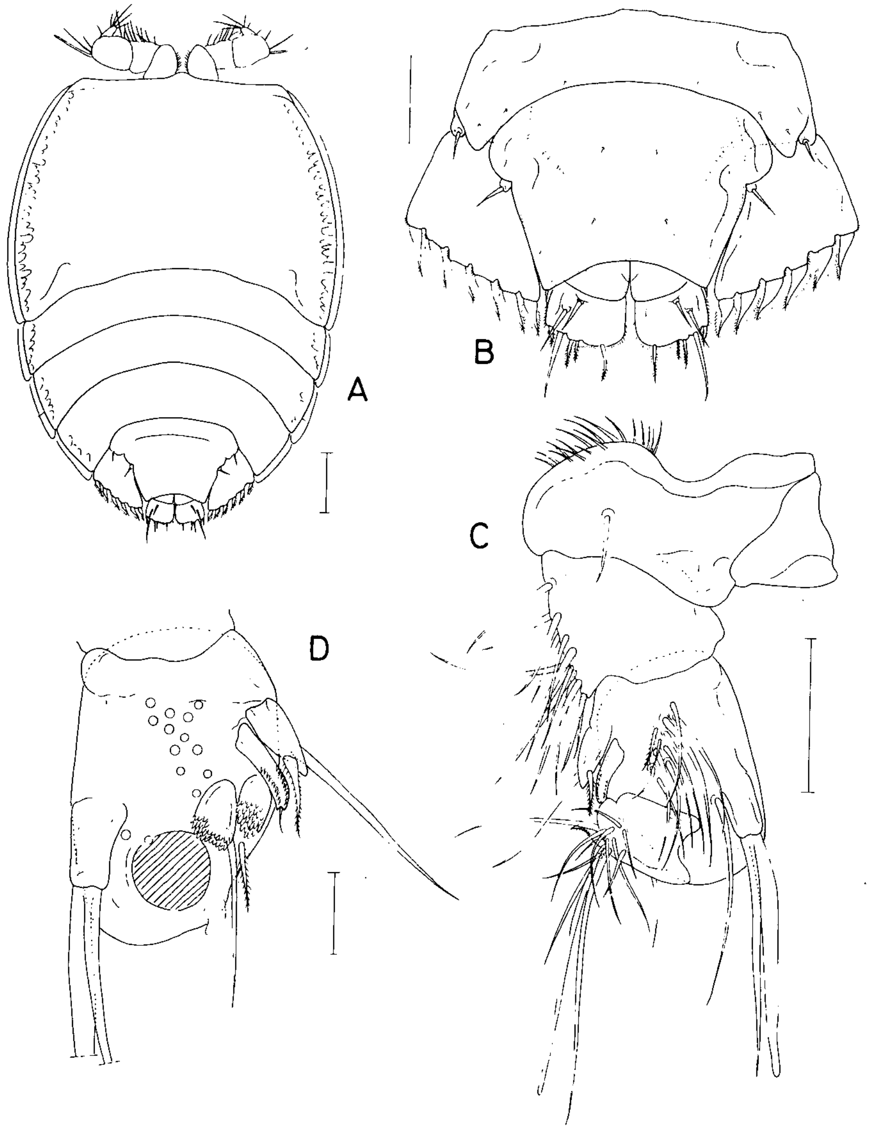

Fig. 9. *Porcellidium ofunatense* Harris and Iwasaki, male. A, habitus, dorsal; B, urosome, dorsal; C, antennule; D, third segment of antennule (open circles represent the places of insertion of setae). Scales: A= 0.1 mm; B, C= 0.05 mm; D= 0.02 mm.

line and small notch on margin. Genital double somite with hairs on posterior 2/3 of lateral margins, tapering posterior parts, and contact with leg 5, without space between them.

Caudal ramus (Fig. 10C) 187 x 68 μm, 2.75 times as long as wide, with longer inner margin, shorter outer margin, therefore forming oblique terminal margin and pointed inner distal corner, and extending over ends of genital double somite. All margins straight. Distal portion of outer and terminal margin with minute spinules. Three dorsal setae small and smooth. α-seta isolated from terminal margin by distance of 90 % length of ramus and 34 % width of ramus from outer margin. β -

seta at 70 % distance from terminal margin and 29 % from outer margin. γ-seta shortest among dorsal setae, and located on terminal margin. Setae 1 and 4 on terminal margin tiny and plumose. Setae 2 and 3 absent.

Rostrum triangular, its anterior portion visible in dorsal view. Antennule (Fig. 10D) 6-segmented and 153 µm long, its setal formula approximately 1, 10, 8, 6+1 aesthetasc, 5, and 7+1 aesthetasc. Antenna (Fig. 10D) with short coxa. Basis with denticles near medial surface and spinules near middle of outer margin. Exopod 1-segmented, with 3 lateral and 3 distal setae, all of them serrated. Endopod 2-segmented. First segment slightly longer than wide, with spinules on medial margin. Second segment with 4 smaller lateral setae, and distally 3 setae (proximalmost one of them short and broad) and 4 spines, distalmost one of the latter short and thick. Other 3 spines setiform.

Mandible (Fig. 10E) of general form. Maxillule (Fig. 10F) with arthrite having 11 setae, two of them subterminally based. Coxa with 5 setae. Basis with 2 distinct endites, each tipped with 4 setae. Exopod with 2 plumose setae. Endopod with 6 setae, midway one of them long and smooth. Other 5 setae plumose at least on one side. Maxilla (Fig. 10G) with syncoxa having 1 endite tipped with 4 setae. Endopod hardly demarcated from allobasis. Maxilliped (Fig. 11A) with syncoxa having a patch of spinules. Basis without setae, but with prominent anterodistal process, long hairs on anterior margin and several longitudinal rows of minute spinules near posterior margin. Endopod 2-segmented. First segment with 1 slender and 1 thick setae. Second segment with 2 thick setae.

Leg 1 (Fig. 11B) with 3-segmented exopod and 2-segmented endopod. Its armature as usual, but outer seta on basis prominently enlarged. Legs 2-4 (Fig. 11C-E) with 3-segmented rami. Armature formula of these 3 legs as follows.

P2: exp. I-1; I-1; III,2,2 enp. 0-1; 0-2; 1,2,1
P3: exp. I-1; I-1; III,2,3 enp. 0-1; 0-2; 1,2,2
P4: exp. I-1; I-1; III,2,3 enp. 0-1; 0-1; 1,2,1

Exopodal spines on outer margins of legs 3 and 4 setiform. Distal seta on endopodal third segment of leg 3 enlarged, spinulated on medial margin, and curved in distal half. Proximal seta of second segment of same ramus also spinulated on medial margin. Other setae plumose. Spinules on outer margin of exopods of legs 2-4 and endopods of legs 3 and 4.

Leg 5 (Fig. 11F) large, embracing abdomen (Fig. 10A), and extending over end of genital double somite. Baseoendopod with 2 distal setae, each on dorsal and ventral surface. Exopod 328 µm long, with minute spinules on nearly all outer margin. Seta on outer margin located distal to midway outer margin. Two among 4 remaining setae located terminally and very small.

Male. Body (Fig. 12A) 742 µm long, with maximum width 492 µm, composed of 4-segmented prosome and 3-segmented urosome. Anterior margin of cephalothorax slightly convex. Rostral area with 3 bubble-like, round processes. Each anterolateral corner of cephalothorax with 3 pointed processes (or curvatures). Cephalothorax and succeding 2 prosomal somites rimmed with membrane on lateral margins of epimeral plates, but no such membrane on epimeral plates of fourth pedigerous somite. Urosome (Fig. 12B) 194 µm long, as long as a quarter of whole body length. Genital somite 83 x 169 µm, with distinctly concave posterior border. Posterior corners pointed and tipped with 1 spinule. Anterolateral portion of lateral margin weakly projected. Caudal ramus 63 x 62 µm, as long as wide, with straight inner margin and slightly convex outer margin. Minute spinules on posterior half of inner margin and posterior part of outer margin. Dorsal setae smooth, γ-seta the longest. Terminal margin with only 3 setae; seta 1 plumose, other 2 setae smooth.

Antennule (Fig. 12D) 4-segmented, geniculate between third and fourth segments, with characteristically long and slender terminal segment. Setal formula approximately 1, 13, 19+1 aesthetasc, and 11+1 aesthetasc. First segment not expanded laterally. Third segment (Fig. 12E) with small tubercle near base, very broad accessory lobe, and 3 highly transformed spines; among these transformed spines, proximalmost one plate-shaped, covered with many rows of spinules; second one curtain-like, elongated; distalmost one bilobed, with 1 seta on one of lobes. Fourth segment slender, longest among segments, with a bundle of setae distally.

Leg 2 with 2 setae on endopodal terminal segment. No sexual dimorphism found in legs 1, 3 and 4. Exopod of leg 5 115 x 75 ㎛, with 6 setae on terminal margin, outermost one of which longer and more slender than the others.

Etymology. The specific name *acutum* derived from the Latin *acutus* (=pointed), alluding to the pointed female caudal rami.

Remarks. Unlike the other species described in this paper, *Procellidium acutum* n. sp. has the rhomboidal caudal rami in female. In addition to this feature, leg 5 embraces whole abdomen, and the female genital double somite is relatively slender and terminated in points. Harris and Robertson (1994) proposed the genus *Acutiramus* for the members having this combination of morphologies, to which they assigned *Porcellidium acuticaudatum* (Thompson and Scott, 1903), *P. brevicaudatum* (Thompson and Scott, 1903), *P. ovatum* Haller, 1879, and thier species *Acutiramus quinquelineatus* and *A. rufolineatus*. In addition to these species more species can be assigned to this group, they are: *P. pagri* Ho, 1986, *P. ravanae* Thompson and Scott, 1903, and *P. tenuicauda* Claus, 1860. However the taxon *Acutiramus* seems less justifiable, as Huys *et al.* (1996) pointed.

Porcellidium acuticaudatum (Thompson and Scott) was synonymized by Lang (1948) to *P. ovatum*.

Porcellidium brevicaudatum (Thompson and Scott) and *P. pagri* Ho have the ratio of length to width of caudal ramus, 1.78 (Hicks and Webber, 1983 for *P. brevicaudatum*) and therefore differ from *Porcellidium acutum* having the ratio 2.78.

According to the illustrations of Huys *et al.* (1996), in *P. ovatum* Haller the female caudal rami have the setae 1, 2 and 4, and the male caudal rami have well developed setae 1-4. In *Porcellidium acutum* the female caudal rami do not have setae 2 and 3, and the male caudal rami have tiny setae 1, 2 and 4, without seta 3.

Porcellicium quinquelineatum (Harris and Robertson) and *P. rufolineatum* (Harris and Robertson) have the body sizes that are distinctly smaller than that of *P. acutum*. The body lengths of these two Australian species are recorded as less than 0.6 mm, and in male less than 0.5 mm. These measurements are dictinctly contrasted to 0.91 mm in female and 0.74 mm in male of *P. acutum*. Additionally, in these Australian species the caudal rami are more slender and not widened distally, unlike in the new species.

In *Porcellidium ravanae* Thompson and Scott, the terminal margin of caudal rami is convex, and the genital double somite is very short and extending only to the base of caudal rami, as shown in

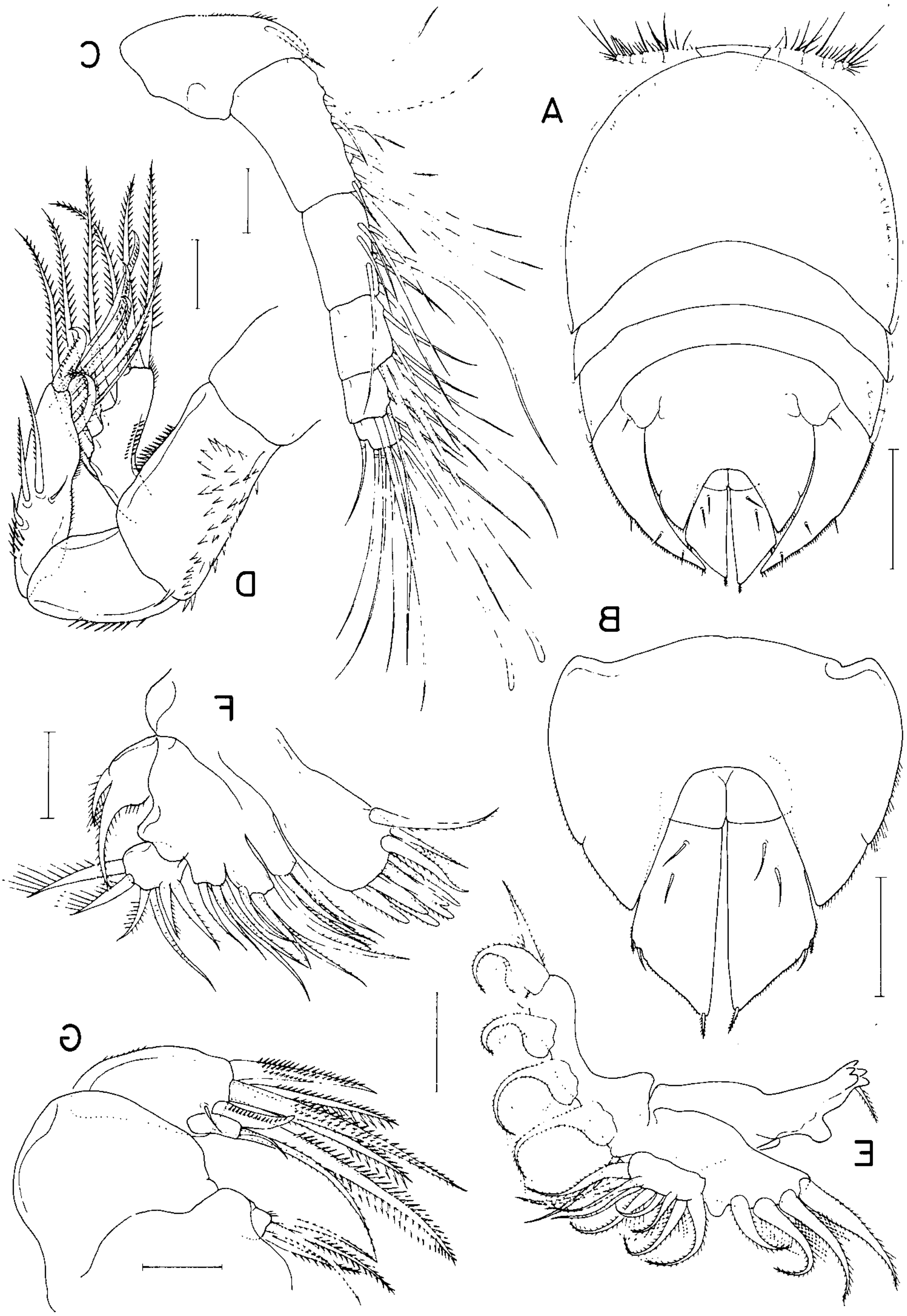

Fig. 10. *Porcellidium acutum* n. sp., female. A, habitus, dorsal; B, abdomen, dorsal; C, antennule; D, antenna; E, mandible; F, maxillule; G, maxilla. A= 0.2 mm; B= 0.1 mm; C, D, F, G= 0.02 mm; E= 0.05 mm.

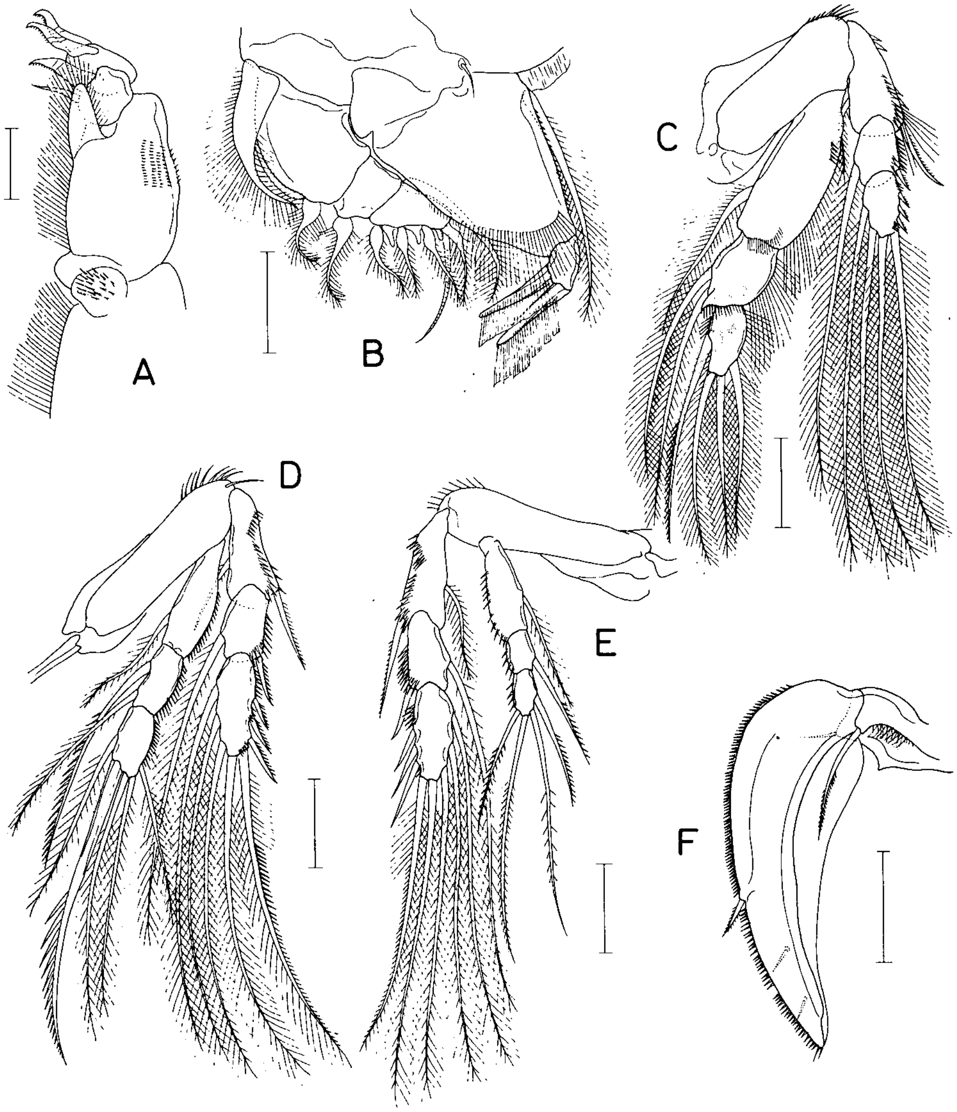

Fig. 11. *Porcellidium acutum* n. sp., female. A, maxilliped; B, leg 1; C, leg 3; D, leg 3; E, leg 4; F, leg 5. Scales: A= 0.02 mm; B-E= 0.05 mm; F= 0.1 mm.

illustrations by Lang (1948). These morphological traits are not observed in *P. acutum*.

Porcellidium tenuicauda Claus is not related to *P. acutum*, because this European species has, according to the illustration of Huys *et al.* (1996), the extremely long terminal margin of caudal ramus which is more than four times as long as inner margin.

Other differential features of the new species are: the maxillular exopod bears two setae (not one) and the posterior cleft of female genital double somite is not longer than half length of the somite.

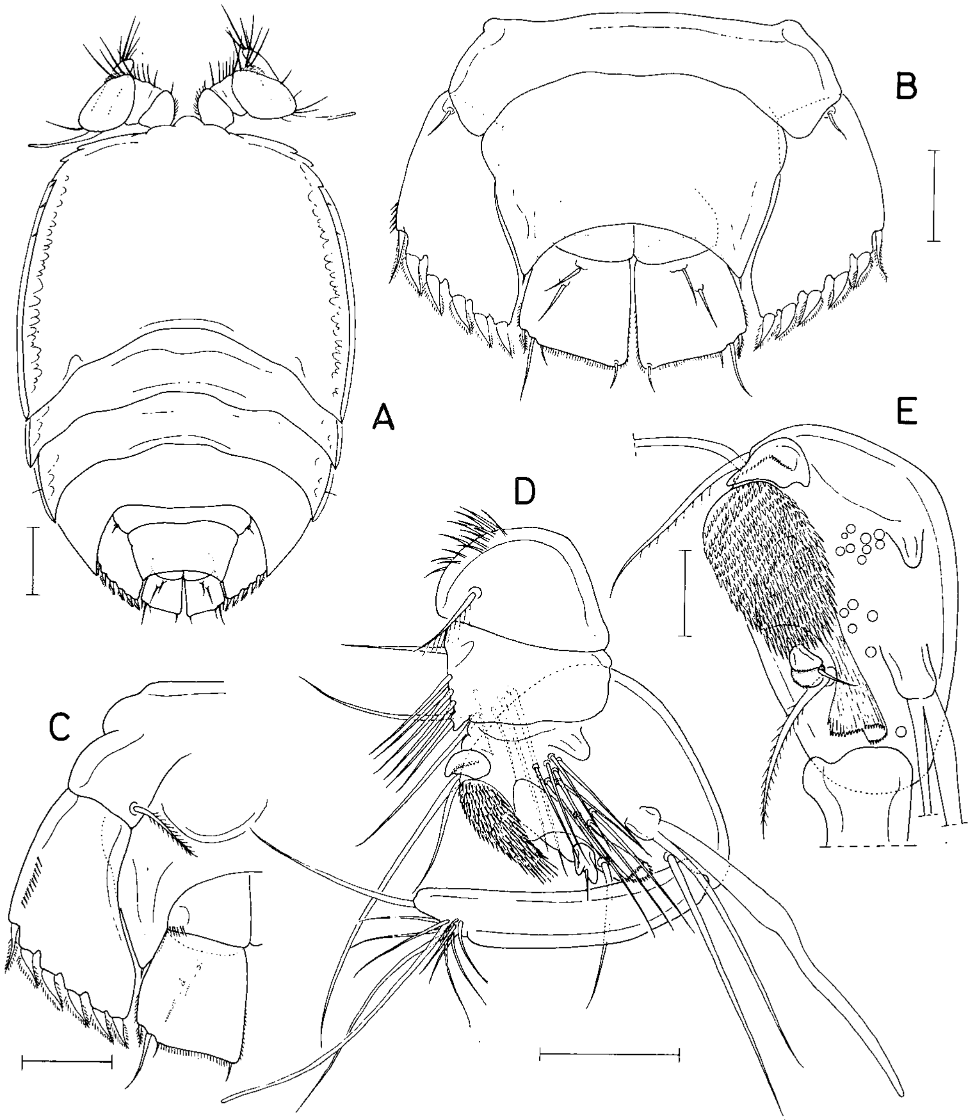

Fig. 12. *Porcellidium acutum* n. sp., male. A, habitus, dorsal; B, urosome, dorsal; C, right part of urosome, ventral; D, antennule, E, third segment of antennule (open circles represent the places of insertion of setae). Scales: A= 0.1 mm; B-D= 0.05 mm; E= 0.02 mm.

Porcellidium gamoi **(Harris and Iwasaki, 1996) (Figs. 13-15)**

Kushia gamoi Harris and Iwasaki, 1996b, p. 208, Figs. 4, 6C-D, 7A-B.

Material examined. 5♀ collected from *Callophyllis japonica* Okamura, at Maemul-do Island, on 22 July 1996;. 5♀♀ 2♂♂ from *Gymnogongrus flabelliformis* Harvey, at Wando Island, on 30 July 1996; 5♀♀ 4♂♂ from *Hizikia fusiformis* (Harvey) Okamura, at Dolsan-do Island, on 31 July

1996; 9♀♀ 1♂ from *Lomentaria hakodatensis* Yendo, at Kijang, on 1 August 1996; 15♀♀ 15♂♂ from *Chondrus ocellatus* Holmes, at Kuryongpo, on 2 August 1996; 9♀♀ 4♂♂ from *Laurencia okamurae* Yamada, at Kuryongpo, 2 August 1996; 66♀♀ 11♂♂ from *Hizikia fusiformis* (Harvey) Okamura, at Kuryongpo, on 2 August 1996: 29♀♀ 3♂♂ from *Laminaria japonica* Areschong, at Kangnung, on 28 May 1997.

Remarks. The present our specimens are identified with *Porcellidium gamoi* (Harris and Iwasaki, 1996) chiefly because of the similarities of caudal rami, the shapes and positions of the setae on caudal rami, the shape of female genital double somite and the morphology of male antennule.

Other observed peculiarities not mentioned in the original description are: the dorsal surface of female caudal rami is scuptured with irregular lines; the terminal part of female caudal rami is heavily sclerotized; and the terminal portion of outer seta on the basis of leg 1 is abruptly curved and narrowed. It is noted that *Porcellidium gamoi*, *P. zosterophilum* and *P. igagurium*, all described by Harris and Iwasaki (1996b), are hardly distinguishable from one another on the basis of their descriptions.

***Porcellidium brevicavum* n. sp. (Figs. 16-18)**

Type specimens. Holotype (♀), allotype (♂), and paratypes (40♀♀ 4♂♂) collected from *Dictyota dichotoma* (Hudson) *Lamouroux*, shallow sublittoral, at Maemul-do Island in Kora Strait, on 22 July 1996.

Other material examined. 81♀♀ 2♂♂ from *Undaria pinnatifida* (Harvey) Suringer, at type locality, on 22 July 1996.

Female. Body (Fig. 16A) 735 ㎛ long, with maximum width 469 ㎛. First three prosomites gradually narrower from anterior to posterior ones, rimmed with membrane on lateral margins of epimeral plates. Urosome 3-segmented, with 2-segmented abdomen (Fig. 16B). Genital double somite 194 x 258 ㎛, semicircular in outline, with round lateral margins and minute spinules on posterior 0.8 of lateral margin. Posterior cleft very shallow 58 x 90 ㎛, wider than long, occupying only 0.3 length of genital double somite. Anterior and posterior lobes of genital double somite completely fused, leaving only vetigial line and small notch. Posterior corners blunt, not pointed.

Caudal ramus (Fig. 16C) short, quadrangular, 57 x 39 ㎛ (1.46:1), slightly widened distally, extending slightly over end of genital double somite, with straight margins. Inner distal corner round. α-seta located at 71 % length of caudal ramus from terminal margin and 35 % width of ramus from outer margin. β-seta located at 28 % from terminal margin and 19 % from outer margin. γ-seta typically smaller than α- and β -setae, and plumose. All 4 setae on terminal margin plumose; setae 2 and 3 closed to each other; seta 3 markedly smaller than others. Minute spinules on distal portion of outer margin and posterior two-thirds of inner margin.

Rostrum triangular, its anterior portion visible in dorsal view. Antennule (Fig. 16D) 141 ㎛ long and 6-segmented, with setal formula approximately 1, 11, 8, 6+1 aesthetasc, 6, and 9+1 aesthetasc. Some of setae faintly plumose. Antenna (Fig. 16E) with short coxa. Basis with broad denticles near medial side. Exopod 1-segmented, with 3 lateral and 3 distal setae, and 1 accompanied setule near base of proximalmost seta. Endopod 2-segmented. First segment slightly longer than wide, with several spinules on medial margin. Second segment with 2 longer and 2 smaller lateral setae, and

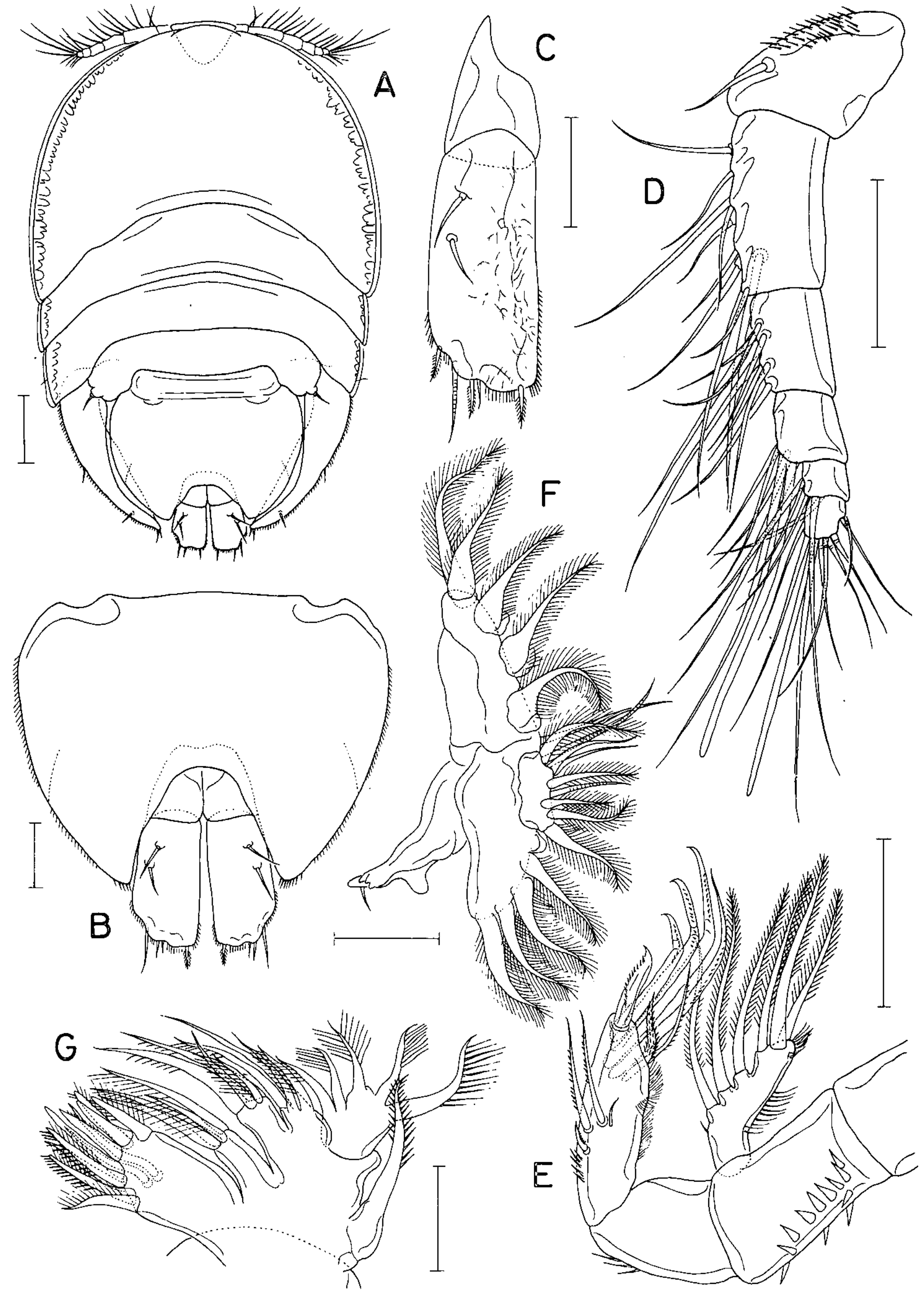

Fig. 13. *Porcellidium gamoi* (Harris and Iwasaki), female. A, habitus, dorsal; B, abdomen, dorsal; C, caudal ramus, left, dorsal; D, antennule; E, antenna; F, mandible; G, maxillule. A= 0.1 mm; B-F= 0.05 mm; G= 0.02 mm.
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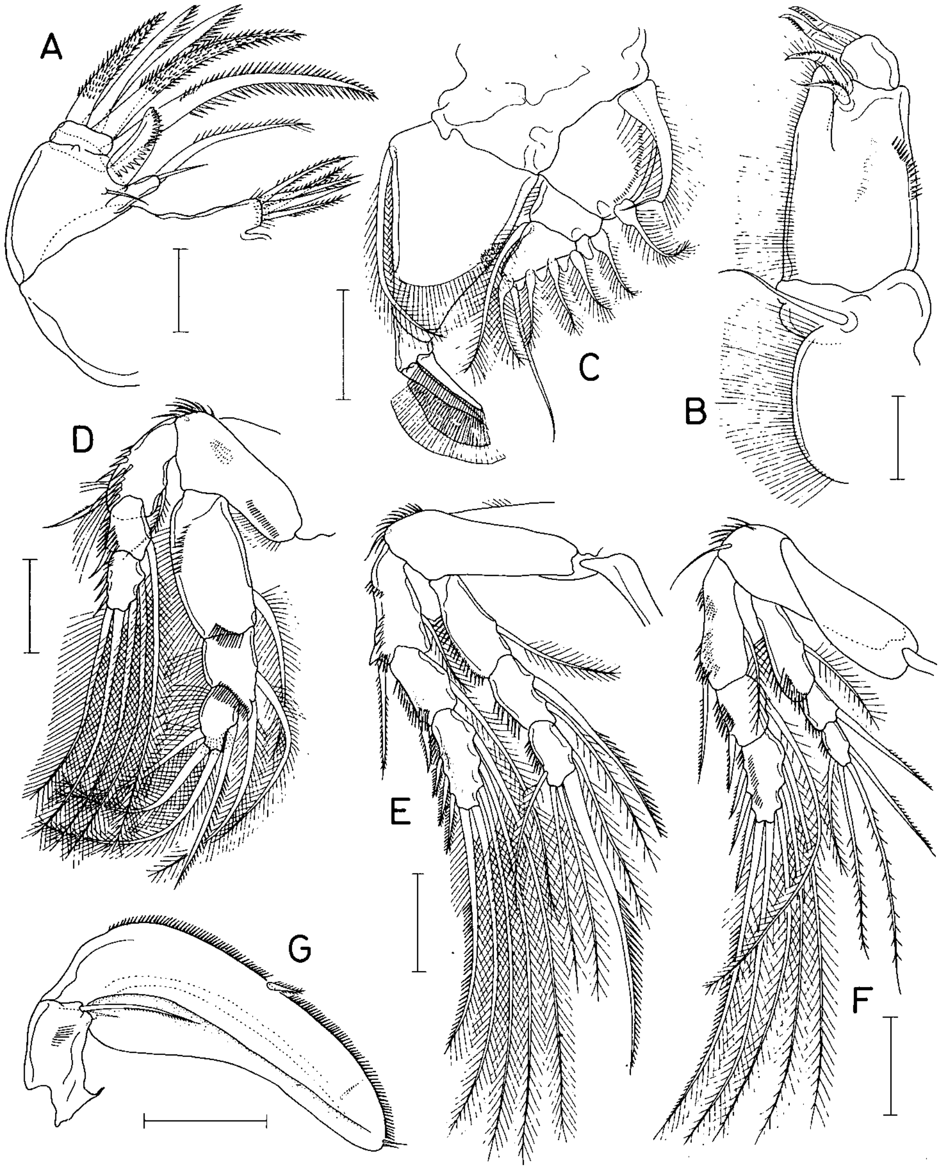

Fig. 14. *Porcellidium gamoi* (Harris and Iwasaki), female. A, maxilla; B, maxilliped; C, leg 1; D, leg 2; E, leg 3; F, leg 4; G, leg 5. Scales: A, B= 0.02 mm; C-F= 0.05 mm; G= 0.1 mm.

distally 3 setae and 4 spines. Distalmost one of spines short, broad and abruptly pointed terminally. Other 3 setae geniculate.

Mandible (Fig. 16F) in general form of the genus. Maxillule (Fig. 17A) with 13 setae on arthrite, two of which subterminally based. Coxa with 5 setae. Basis with 2 distinct endites, each endite armed with 4 setae. Exopod with 1 large seta. Endopod with 6 setae, all of them plumose. Syncoxa of

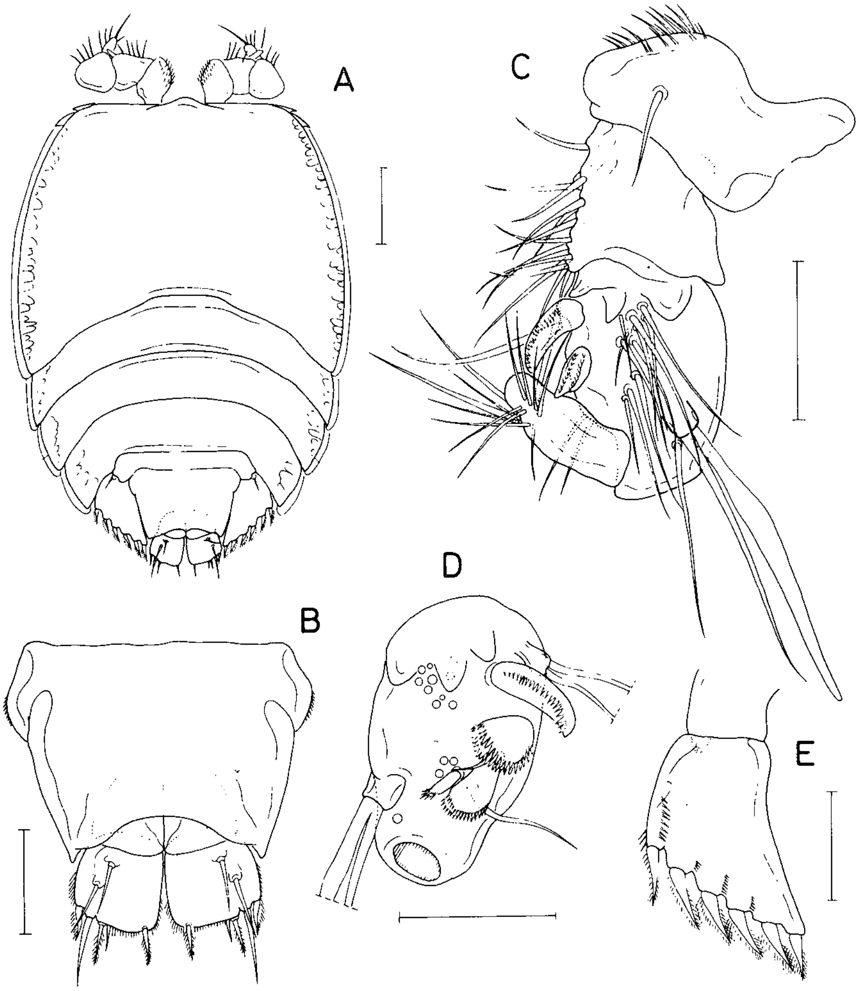

Fig. 15. *Porcellidium gamoi* (Harris and Iwasaki), male. A, habitus, dorsal; B, abdomen, dorsal; C, antennule; D, third segment of antennule; E, leg 5, ventral. Scales: A= 0.1 mm; B-E= 0.05 mm.

maxilla (Fig. 17B) with 1 endite having 5 setae; endopod 1-segmented, with 5 setae, one of them slender. Maxilliped (Fig. 17C) with 1 long, smooth seta on syncoxa. Basis unarmed, with large anterodistal and posterodistal expansions; anterior margin with long hairs; posterior margin with spinules. Enodpod 2-segmented, with 2 setae on each segment.

Leg 1 (Fig. 17D) with 3-segmented exopod and 2-segmented endopod; armature as in other species. One of setae on exopodal terminal segment smooth, more slender and longer than other setae of same segment. Legs 2-4 (Fig. 17E-G) with 3-segmented rami and following armature formula:

P2: exp. I-1; I-1; III,2,2 enp 0-1; 0-2; 1,2,1
P3: exp. I-1; I-1; III,2,3 enp. 0-1; 0-2; 1,2,2
P4: exp. I-1; I-1; III,2,3 enp. 0-1; 0-1; 1,2,1

Endopodal terminal segment of leg 2 with serrate seta. Distal seta on endopodal third segment of leg 3 serrate as well. Proximal seta of second segment of same leg serrate, but not broadened. Other setae plumose. Exopods of legs 2-4 and endopod of leg 4 with spinules on outer margins.

Leg 5 (Fig. 17H) with 2 distal setae, each on dorsal and ventral surfaces. Exopod 172 ㎛ long, not extending to end of genital double somite, with spinules on almost all lateral margins. Seta on lateral margin located distal to midway of margin. Two of other 3 setae located near distal end.

Male. Body (Fig. 18A) 632 ㎛ long, with maximum width 446 ㎛, composed of 4-segmented prosome and 3-segmented urosome. Anterior margin of cephalothorax straight, but rostral area weakly convex. Anterior corners of cephalothorax each with 2 spiniform processes. All prosomites with membranous rim on lateral margins. Genital somite 83 x 145 ㎛, with convex anterior border and concave posterior border. Lateral margin roundly convex proximally (Fig. 18B). Both posterior corners tipped with 1 spinule. Caudal ramus 40 x 43 ㎛, slightly wider than long, with round inner distal corner. Three dorsal setae smooth, of which r-seta longest. Among setae on terminal margin, setae 1, 2 and 4 plumose, setae 3 tiny, smooth and closed to seta 2. Terminal margin and posterior half of outer margin with hairs.

Antennule (Fig. 18C) 4-segmented, geniculate between third and fourth segments, with setal formula approximately 1, 13, 17+1 aesthetasc, and 12+1 aesthetasc. First segment greatly expanded laterally, with hairs on anterior margin. Third segment (Fig. 18D) without proximal process, but with accessory lobe tipped with 1 long, smooth seta and 1 short, plumose seta; among 3 transformed spines on this segment, proximalmost one rod-shaped and tipped with 1 smalle seta; other 2 spines denticulate and tipped with 1 seta. Terminal segment wider than long, with a bundle of setae terminally, one of which spiniform.

Endopodal terminal segment of leg 2 armed with 2 setae. Legs 1, 3 and 4 showing no sexual dimorphism. Exopod of leg 5 80 x 70 ㎛; all setae on terminal margin identical in shape and plumose.

Etymology. The specific name brevicavum is derived from the Latin *brevis* (=small) + *cavum* (=excavation). It alludes to the shallow posterior cleft of the female genital double somite.

Remarks. This new species, being a *naviculum* group of Harris and Robertson (1994), has the characteristical stocky caudal rami (ratio 1.46) and very small posterior cleft of genital double somite. Such features can also be observable in *P. naviculum* Harris and Robertson, 1994. However, the β-seta of caudal ramus of *P. naviculum* is located neaar the terminal margin, unlike in *P. brevicavum* n. sp. in which the β-seta is isolated from the terminal margin. In contrast to the new species, *P. naviculum* bears the exopod of female fifth leg that is markedly short and abruptly tapering in distal third. In addition to these, the male antennule of *P. naviculum* has two transformed spines on the third segment, but in *P. brevicavum* they are three on the same segment. *Porcellidium phyllosporum* Harris and Robertson, 1994 also has stocky caudal rami. However, this species is not

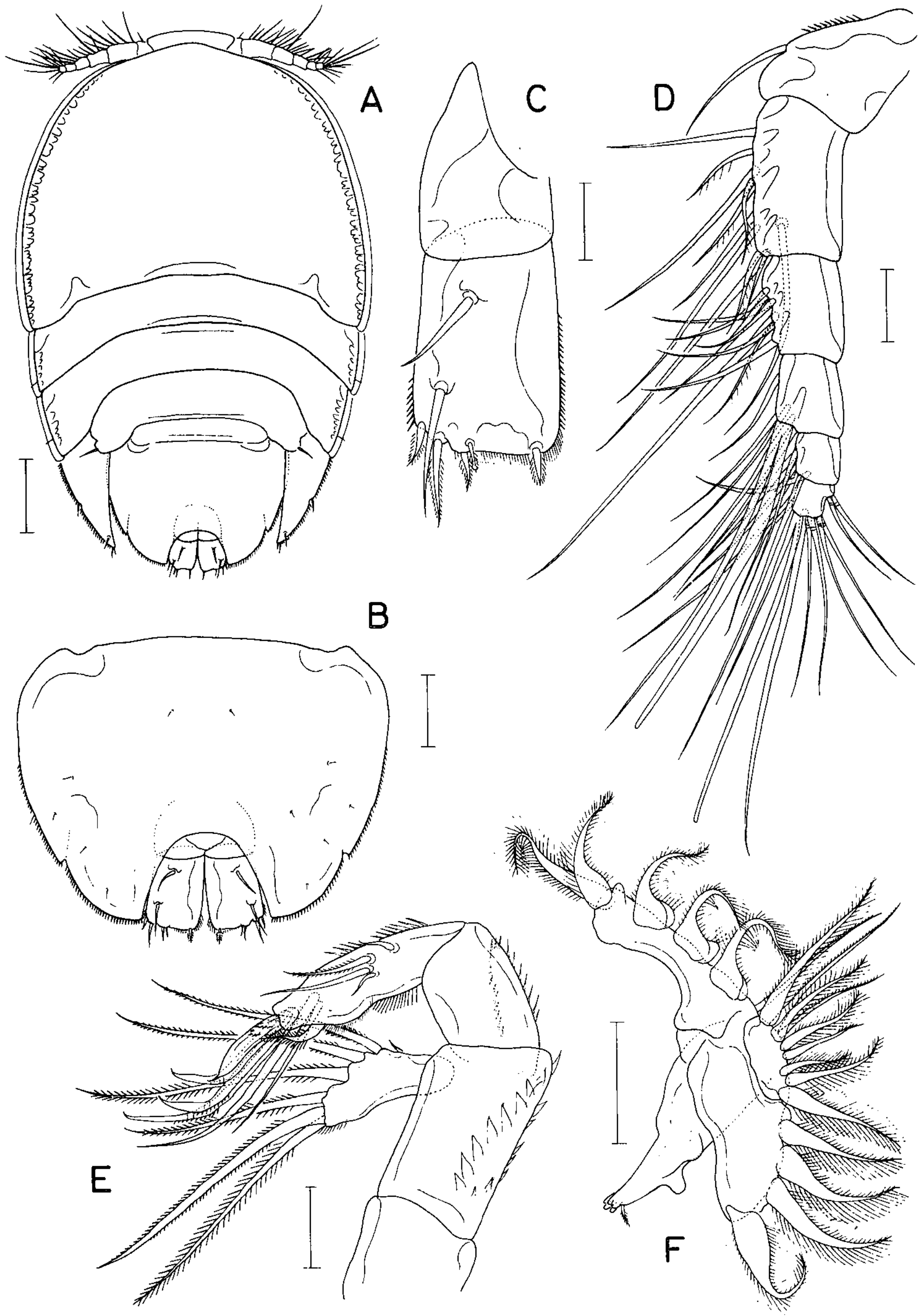

Fig. 16. *Porcellidium brevicavum* n. sp., female. A, habitus, dorsal; B, abdomen, dorsal; C, caudal ramus, left, dorsal; D, antennule; E, antenna; F, mandible. A= 0.1 mm; B, F= 0.05 mm; C-E= 0.02 mm.

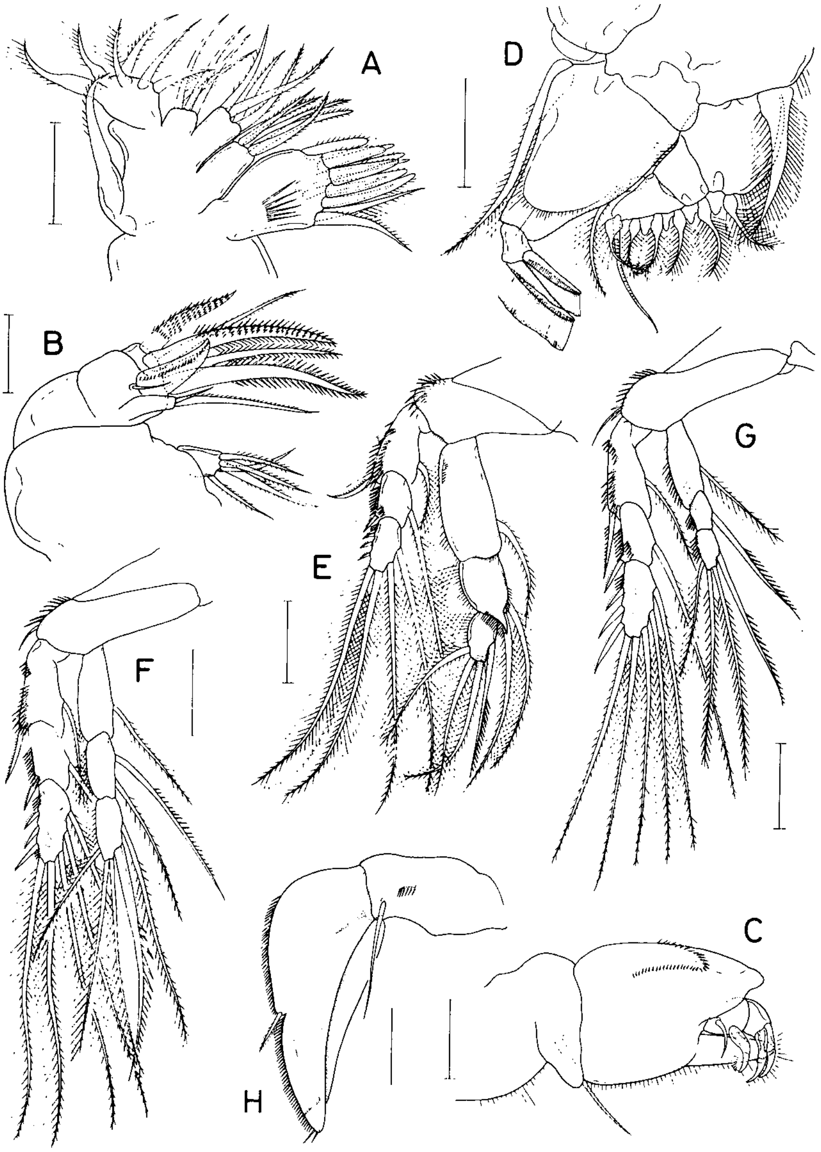

Fig. 17. *Porcellidium brevicavum* n. sp., female. A, maxillule; B, maxilla; C, maxilliped; D, leg 1; E, leg 2; F, leg 3; G, leg 4; H, leg 5. Scales: A, B, C= 0.02 mm; D-H= 0.05 mm.

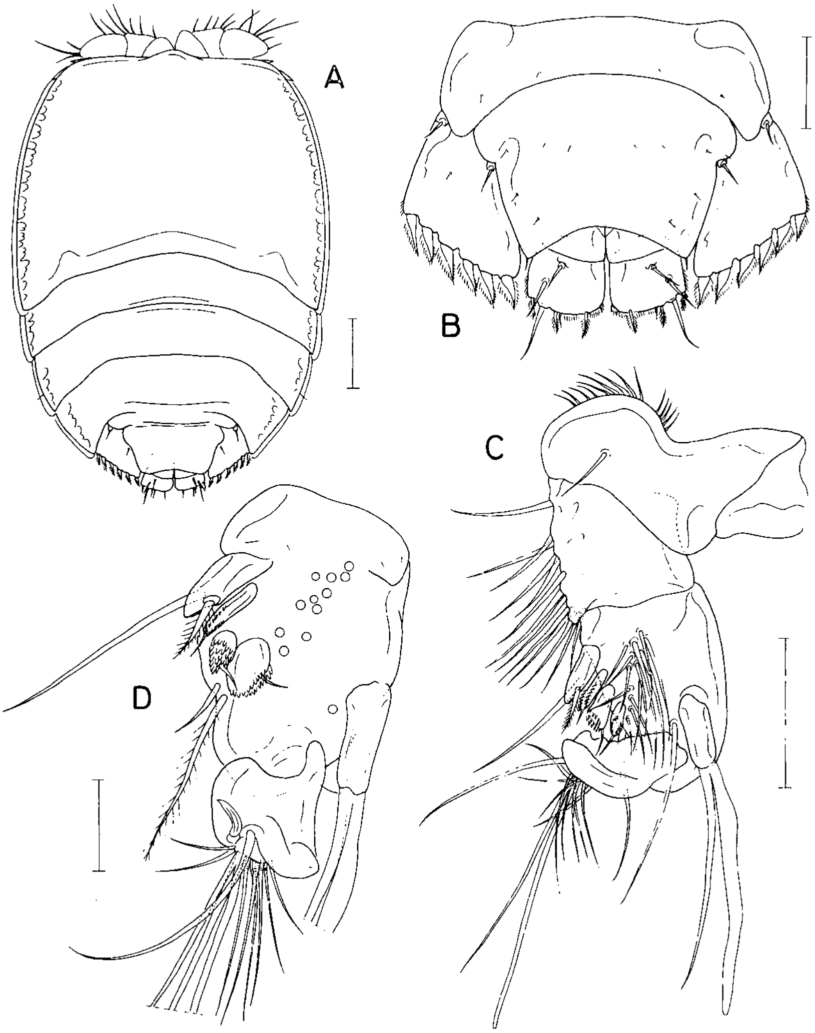

Fig. 18. *Porcellidium brevicavum* n. sp., male. A, habitus, dorsal; B, urosome, dorsal; C, antennule; D, terminal segments of antennule (open circels represent the places of insertion of setae). Scales: A= 0.1 mm; B, C= 0.05 mm; D= 0.02 mm.

related to *P. brevicavum*, because this Australian species has a distinctly broader genital double somite.

DISCUSSION

Twenty-two species of macroalgae were found in this research to be the habitats of the examined harpaciticoids of *Porcellidium*. They are consisted of eight species of red algae, ten species of brown algae, and four species of green algae (Table 1). At Kyeogpo and Chindo Island in the Yellow Sea, several macroalgae were examined for the species of *Porcellidium* but yielded no *Porcellidium* material. These examined macroalgae were: *Lomentaria hakodatensis*, *Sargassum thunbergii*, *Chodium fragile* and *Enteromorpha linza* in Kyeogpo, and *Chondrus ocellatus*, *Laurencia okamurae*, *Hizikia fusiformis* and *Sargassum thunbergii* in Chindo Island.

Table 1. Distribution of examined *Porcellidium* species on their algal associates

Algal species	*P. bipartitum*	*P. wandoensis*	*P. ofnatense*	*P. acutum*	*P. gamoi*	*P. brevicavum*
Red algae						
Callophyllis japonica Okamura					+	
Chondrus ocellatus Holmes		+	+		+	
Gymnogongrus flabelliformis Harvey		+	+		+	
Laurencia okamurae Yamada		+			+	
Lomentaria hakodatensis Yendo					+	
Pachymeniopsis elliptica (holmes) Yamada			+			
Symphyocladia latiuscula (Harvey) Yamada		+				
S. linearis (Okamura) Falkenberg		+				
Brown algae						
Dictyota dichotoma (Hudson) Lamouroux						+
Ecklonia cava Kjellman	+					
Hizikia fusiformis (Harvey) Okamura		+			+	
Ishige okamurae Yendo		+				
Sargassum confusum C. Arardh				+		
Sargassum fulvellum (Turner) C. Agardh				+		
Sargassum thunbergii (Roth) Kuntze		+				
Undaria pinnatifida (Harvey) Suringer						+
Agarum cribrosum Bory f. *yakishiriense* Yamada				+		
Laminaria japonica Areschong			+		+	
Green algae						
Caulerpa okamurae Werber van Bosse			+			
Chodium fragile (Suringer) Hariot		+	+	+		
Enteromorpha linza (L.) J. Agardh		+				
Ulva pertusa Kjellman			+	+		

On the other hand, all the six *Porcellidium* species were discovered in the Korea Strait and five species in the Sea of Japan. Judging from these distributions, the harpacticoids of *Porcellidium* seem to favor the clear and undiluted sea water. Moreover they are thought to be warm-water animals according to Harris and Iwasaki (1996a) who collected in Japan more specimens in October than in December.

Among the discovered species, *Porcellidium bipartitum* and *P. brevicavum* are limited in their selections of algae as habitats. The former species were found only from *Ecklonia cava*, and the latter from *Undaria pinnatifida* and *Dictyota dichotoma*, all the three being the brown algae. In contrast to these two harpacticoids, other four examined species each were found to inhabit various algae: *Porcellidium wandoensis* were found from ten species of algae, *P. ofunatanse* and *P. gamoi* each from seven species of algae, and *P. acutum* from five species of algae. In Dolsan-do Island, three species of *Porcellidium, P. wandoensis, P. gamoi* and *P. brevicavum* were collected simultaneously from a single species of green algae, *Chodium fragile.*

In Japanese waters, Harris and Iwasaki (1996b) recorded *Porcellidium pacificum* as *Clavigofera pacifica*), *P. gamoi* (as *Kushia gamoi*) and *P. igagurium* (as *Kushia igaguria*) from *Sargassum sargassum* var. *yezoense*. In Korean waters these harpacticoids were not discovered from the same genus of algae. Instead, *P. acutum* was discovered from both *Sargassum confusum* and *S. fulvellum*, and *P. wandoensis* from *S. thunbergii*. In these respects, the harpacticoids of *Porcellidium* seem to have low specificities in selection of macroalgae as the habitats. This assumption may be supported from the fact that two among the six examined species of *Porcellidium* were found from three phyla of macroalgae and four species of *Porcellidium* from two phyla of algae. Such low specificities may suggest that the harpacticoids of this genus do not feed on the attached algae or the algal secretions. Despite of this, most of the known species of Porcellidium have been discovered on the macroalgae. This allows, in turn, to suspect that there should be a close ecological relationship between the animals and plants. It is needed the careful experiments and observations to elucidate their possible ecological relationships.

The genus *Porcellidium* is known of seven species from Japanese waters and six species (in the present paper) from the Korean waters, both areas belonging to a same zoogeographic region. Among these species, only two are known to distribute in common in both areas. This informs us that a number of more species can be discovered in each area.

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한국의 해조류에 부착하는 *Porcellidium* 속의 요각류(하르팍티쿠스목)

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요약

동해 및 남해의 22종의 해조류에 서식하는 *Porcellidium* 속의 요각류 6종을 기재하였다. 이 중에서 *Porcellidium ofunatense* Harris and Iwasaki와 *Porcellidium gamoi* (Harris and Iwasaki)는 한국내 미기록종이다. 나머지 4종은 신종으로 기재하였으며, 이들은 1종의 해조에서 발견된 *Porcellidium bipartitum* n. sp., 10종의 해조에서 발견된 *P. wandoensis* n. sp., 5종의 해조에서 발견된 *P. acutum* n. sp., 그리고 2종의 해조에서 발견된 *P. brevicacum* n. sp.이다. *Porcellidium* 속의 종과 해조류 사이의 특이성은 낮게 나타났다.